PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
G08B 15/00, G07F 7/10, G07G 3/00

A1

(11) International Publication Number: WO 98/01838

(43) International Publication Date: 15 January 1998 (15.01.98)

(21) International Application Number: PCT/US97/12000

(22) International Filing Date: 10 July 1997 (10.07.97)

(30) Priority Data:
08/677,513 10 July 1996 (10.07.96) US
08/889,889 9 July 1997 (09.07.97) US

(71)(72) Applicant and Inventor: SULLIVAN, Patrick, J. [NZ/US]; 3500 Mount Vernon Way, Plano, TX 75025 (US).

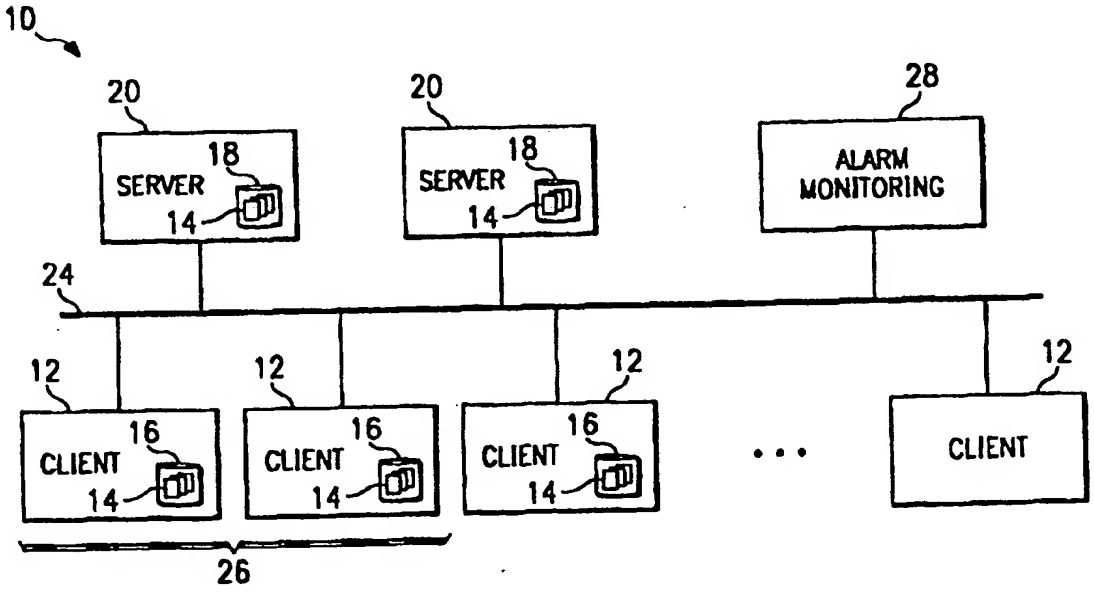
(72) Inventor: SAWAF, Ziad; 17827 Windflower Way #109, Dallas, TX 75252 (US).

(74) Agent: SHOWALTER, Barton, E.; Baker & Botts, L.L.P., 2001 Ross Avenue, Dallas, TX 75201-2980 (US).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: VIDEO SURVEILLANCE SYSTEM AND METHOD



(57) Abstract

A video surveillance system includes clients coupled to servers using a network. The clients generate digital files that may include data, video, and audio. Using the network, the clients communicate the digital files to the servers for monitoring, analyzing, and reporting on the financial transactions occurring at the clients. The clients may also communicate in real-time the data, video, and optionally audio to the servers. The video surveillance system also supports receiving stored data upon connection between the clients and the servers.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

VIDEO SURVEILLANCE SYSTEM AND METHOD

TECHNICAL FIELD OF THE INVENTION

This invention relates in general to surveillance and communication systems, and more specifically to a video surveillance system and method.

BACKGROUND OF THE INVENTION

A point-of-sale (POS) device, an automated teller machine (ATM), or other similar device generates data associated with a financial transaction. For example, a POS device may generate data associated with the sale of an item, whereas an ATM may generate data associated with a cash withdrawal by a customer. Due to human error, intentional misconduct, or machine malfunction, there may be a desire to display or analyze events associated with these financial transactions.

Existing surveillance systems provide some monitoring of financial transactions. For example, some surveillance systems capture data associated with financial transactions for later analysis and reporting. Other surveillance systems store video images on videotape for later visual analysis and reporting of the event. Still other systems associate or overlay financial transaction data with video stored on videotape.

SUMMARY OF THE INVENTION

In accordance with the present invention, the disadvantages and problems associated with surveillance systems have been substantially reduced or eliminated. In particular, the present invention

provides a video surveillance system and method that combines data, video, and optionally audio associated with a financial transaction in a digital file. A server retrieves the digital file from the client and provides a graphical interface to retrieve the data, video, and optionally audio from the digital file for presentation and analysis. In another embodiment, the present invention provides a video surveillance system and method that combines data, video, and optionally audio associated with a financial transaction and transmits this information in real-time to a server. A server displays the data in a data window which is overlaid on a video image corresponding to the data.

In accordance with one embodiment of the present invention, a video surveillance system includes a client that generates data associated with a financial transaction. The client has a camera that generates video associated with the financial transaction. The client stores data and video in a digital file. A server is coupled to the client using a communications network and receives the digital file from the client and stores the digital file in a memory. The server has a graphical interface that retrieves data and video from the digital file stored in the memory for presentation.

In accordance with another embodiment of the present invention, a video surveillance system includes a client that generates data associated with a financial transaction. The client has a camera that generates video associated with the financial transaction. The client transmits the data and video over a communication network. A server is coupled to the client using the communications network and receives the data and video from the client. The server displays the video and data in real-time.

Important technical advantages of the present invention include the storage and/or real-time transmission and viewing of data, video, and optionally audio associated with a financial transaction. In particular, a client, such as a point-of-sale (POS) device like a cash register or an automated teller machine (ATM), generates data associated with and/or upon the occurrence of a financial transaction. The client also includes a camera that generates associated video and optionally a microphone that generates associated audio. The client may store data, video, and audio in a single multimedia digital file. In a particular embodiment, the client includes two modes of operation. In the first mode, the client includes only data associated with the financial transaction in the digital file. In the second mode associated with an exception condition of the financial transaction, the client includes data, video, and optionally audio in the digital file. The exception condition may be defined by information transmitted from the server.

The storage of different information into a digital file provides several important technical advantages. The digital file may be formatted, compressed, and communicated using digital communications technology. The digital file may be scrambled, rearranged, encoded, or otherwise processed to prevent tampering or disassociation of data, video, and audio. Also, a digital file format allows more sophisticated database storage, retrieval, and reporting functions.

Another important technical advantage of the present invention includes a server coupled to the client that retrieves the digital file. The server includes a graphical interface that allows a user of the server to display, analyze, and generate reports

on information contained in the digital file. In a particular embodiment, the server is coupled to a plurality of clients, and each client generates digital files for financial transactions occurring at the client. The server collects and stores these digital files in a database. The graphical interface accesses the database to allow selection, presentation, analysis, and reporting of the financial transactions represented by the digital files. In a particular embodiment, data for each financial transaction appears as an entry in a table of financial transactions. Highlighted entries may indicate the existence of video associated with the data. The graphical interface may also include a video window for viewing associated video and a search/report window to allow selection and analysis of financial transactions.

In another embodiment, the client provides a further technical advantage by transmitting data, video, and audio across a communications network in real-time. Additionally, data can be transmitted from the client to the server upon initialization of a real-time connection. This data may represent daily sales total, transaction totals, number of items sold since last contact or some other information. In this embodiment, a server coupled to the client receives the transmitted data and video. The server includes a display that allows the data to be shown as a data window overlaid on the associated video. Multiple data windows as well as multiple video windows can be displayed. In a particular embodiment, the server is coupled to a plurality of clients and each client transmits data and video for financial transactions occurring at the client. The server displays these transactions in multiple windows. An operator can change the views in the windows or the windows can be

changed automatically, based on some preexisting criteria. Other technical advantages are readily apparent to one skilled in the art from the following figures, descriptions, and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and for further features and advantages, reference is now made to the following written description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 illustrates a video surveillance system;

FIGURE 2 illustrates a client in the video surveillance system;

FIGURE 3 illustrates a server in the video surveillance system;

FIGURE 4 illustrates a graphical interface at the server in the video surveillance system;

FIGURE 5 illustrates the components of an exemplary digital file used in the video surveillance system;

FIGURE 6 is a flowchart of a method of operation of the client in the video surveillance system;

FIGURE 7 is a flowchart of a method of operation of the server in the video surveillance system;

FIGURE 8 illustrates a video surveillance system capable of real-time transmission of video and data;

FIGURE 9 illustrates a display which includes a video window and one or more data windows;

FIGURE 10 illustrates a display divided into multiple video windows and data windows;

FIGURE 11 is a flowchart of real-time data and video transmission; and

FIGURE 12 is a flowchart for a method of updating data from a client.

DETAILED DESCRIPTION OF THE INVENTION

FIGURE 1 illustrates a video surveillance system 10 that includes clients 12 coupled to servers 20 using a communications network 24. In operation, clients 12 generate digital files 14 that include data, video, and optionally audio associated with financial transactions. Clients 12 communicate digital files 14 to servers 20 using network 24. Servers 20 store digital files 14 received from clients 12 in databases 18, and provide remote monitoring, reporting, and analysis of financial transactions occurring at clients 12.

Clients 12 may include or be associated with any electronic device that generates data on a financial transaction, such as a point-of-sale (POS) device like a cash register, automated teller machine (ATM), or any other appropriate device that generates data on a financial transaction. Clients 12 may be located at one or more sites, associated with one or more business organizations, or otherwise arranged or grouped in any appropriate manner. For example, two or more clients 12 may be co-located at a site, operated by the same business organization, or otherwise associated as indicated by bracket 26. Each server 20 in system 10 receives digital files 14 associated with financial transactions occurring at one or more designated or associated clients 12. System 10 contemplates any association or arrangement of clients 12 and servers 20 to accomplish remote monitoring and analysis of financial transactions.

Network 24 represents hardware and software used in any suitable communications network or computer network, such as a local area network (LAN), wide area network (WAN), public switched telephone network, integrated services digital network (ISDN), switched-56 telephone network, private branch exchange (PBX),

the global computer network known as the Internet, or any other appropriate technology or technique that allows components of system 10 to communicate information. Although client 12 and server 20 are referred to in the nomenclature of a client/server environment, it should be understood that client 12 and server 20 may be any type of computer operating in any suitable environment that communicates using network 24. Each component in system 10 includes any suitable hardware and software components to interface with and communicate using network 24.

In a particular embodiment, network 24 supports one-way and two-way audio/video conferencing. Throughout this description, audio/video conferencing includes conferencing of audio alone, video alone, or both audio and video, together with any associated data. For example, network 24 may include components to implement an integrated services digital network (ISDN) communications facility that supports the ITU H.320 video conferencing standard. In this embodiment, each component of system 10 may include appropriate transceivers, coders/decoders (codecs), interface cards, and other hardware and software to implement audio/video conferencing and underlying data transfer.

An alarm monitoring station 28 is also coupled to network 24 and detects alarm conditions at clients 12. In response to this detection, station 28 establishes communication with the particular client 12 that generates the alarm condition. Station 28 may display in a direct, dedicated, real-time, or near real-time fashion data, video, and audio generated at the particular client 12 that generated the alarm condition. Station 28 may also perform one-way or two-way audio/video conferencing with the particular client 12. In a particular embodiment, station 28

alerts and dispatches police, fire, security, or other officials to client 12.

In operation, clients 12 perform financial transactions and generate digital files 14 associated with the financial transactions for storage in databases 16. At appropriate times, server 20 receives digital files 14 from clients 12, and stores these digital files 14 in database 18. In one embodiment, database 18 maintained at server 20 includes digital files 14 collected from numerous clients 12. Server 20 includes a database management system and a graphical interface to display, select, analyze, and report on financial transactions occurring at clients 12 that correspond to digital files 14 maintained in database 18.

FIGURE 2 illustrates client 12 in more detail. On-site input/output devices 50 include microphone 52, speaker 54, cameras 56, and display 58. A video switch 60, coupled to cameras 56 and display 58, selects video from one or more cameras 56. A video cassette recorder (VCR) 62 or other appropriate recording device is coupled to input/output devices 50, and records video and audio information on videotape 64.

Input/output devices 50 are coupled to a converter 70, which passes video 72 and audio 74 in digital format to a controller 76. Controller 76 is coupled to and receives data 82 regarding a financial transaction from ATM 78, POS 80, or any other device that generates data 82 regarding a financial transaction. An alarm 83 is also coupled to controller 76, and represents a motion detector, clock, panic button, or other device that generates an alarm condition 85 at client 12.

Controller 76 is coupled to database 16 which stores digital files 14 and exception condition 84.

Exception condition 84 comprises information that directs client 12 when to store video and optional audio for particular financial transactions. For example, exception condition 84 may represent one or more activities, such as keystrokes at ATM 78 or POS 80, that when detected in data 82 triggers the capture of video 72 and/or audio 74 for the financial transaction. Exception condition 84 may be defined as a noise threshold in audio 74 or a pixel or picture variance or difference threshold in video 72 that, when exceeded, triggers the capture of video 72 and audio 74. Controller 76 is also coupled to codec 86, which in turn is coupled to network 24 using interface 88.

Particular components of client 12 may operate on one or more computers, shown generally as computer 90. Computer 90 maintains and executes the instructions to implement converter 70, controller 76, codec 86, and interface 88, and includes any suitable combination of hardware and software to provide the described function or operation of these components. Database 16 comprises one or more files, lists, or other arrangement of information stored in one or more components of random access memory (RAM), read only memory (ROM), magnetic computer disk, CD-ROM, other magnetic or optical storage media, or any other volatile or nonvolatile memory.

Computer 90 includes an input device 92 such as a keypad, touch screen, mouse, or other device, that can accept information. Output device 94, such as a computer display or speaker, conveys information associated with the operation of client 12, including digital data, visual information, or audio information. Both input device 92 and output device 94 may include fixed or removable storage media such as a magnetic computer disk, CD-ROM, or other suitable

media to both receive output from and provide input to client 12. Processor 96 and its associated memory execute instructions and manipulate information in accordance with the operation of client 12.

In operation, input/output devices 50 may operate in an analog or mixed analog/digital environment. For example, cameras 56 may generate and display 58 may display video in a standard television format such as NTSC or other analog signal format. Similarly, microphone 52 may generate and speaker 54 may convey audio information in analog form. If appropriate, converter 70 converts analog signals used by one or more input/output devices 50 into digital signals for video 72 and audio 74 used by controller 76. In one embodiment, input/output devices 50 generate and receive digital data and the operation of converter 70 is unnecessary.

Upon the occurrence of a financial transaction, ATM 78 or POS 80 generates data 82 associated with the financial transaction. Controller 76 analyzes video 72, audio 74, and/or data 82 to determine if it indicates, corresponds to, or is associated with exception condition 84 stored in database 16. In a first mode, controller 76 determines that video 72, audio 74, and/or data 82 are not associated with exception condition 84 and stores only data 82 generated by ATM 78 or POS 80 as digital file 14 in database 16. In a second mode, controller 76 determines that video 72, audio 74, and/or data 82 generated by ATM 78 or POS 80 is associated with exception condition 84, which triggers the capture of video 72 and optionally audio 74. Therefore, in the second mode of operation, controller 76 includes data, video 72, and optionally audio 74 associated with the financial transaction in digital file 14 stored in database 16.

Contemporaneously with the storage of digital file 14 in database 16 or at an appropriate later time, controller 76 retrieves one or more digital files 14 from database 16 for transmission to server 20 using codec 86, interface 88, and network 24. Client 12 may schedule delivery of digital files 14 to server 20 in any appropriate manner. For example, client 12 may communicate digital files 14 to server 20 at off-peak hours, at the end of a shift, at specified intervals during a day, week, or month, or at any other appropriate time, depending on the particular requirements of the business organization operating client 12. In addition, client 12 may initiate communication of digital files 14 in response to a command received from server 20 over network 24. Also, alarm condition 85 generated by alarm 83 may cause client 12 to immediately communicate digital file 14 associated with alarm condition 85. In this embodiment, client 12 may transmit alarm condition 85 to station 28 and establish a direct, dedicated, real-time, or near real-time one-way or two-way audio/video conference with station 28.

In combination with or separate from the generation and communication of digital files 14, client 12 also supports one-way and two-way audio/video conferencing using network 24. For one-way audio/video conferencing, converter 70 passes video 72 from cameras 56 and audio 74 from microphone 52 to controller 76. Controller 76 and codec 86 place video 72 and audio 74 into an appropriate format such as the video conferencing standard described in ITU H.320. Controller 76 may also include any data generated at client 12 in the conferencing information. In a particular embodiment, one-way audio/video conferencing signals are multiplexed and compressed onto a single digital bit data stream and

transmitted to server 20 or station 28 using the ISDN communications standard supported by network 24.

For two-way audio/video conferencing, the components of client 12 perform the same outgoing conferencing capability, but also receive audio/video conferencing signals from server 20 using network 24, interface 88, and codec 86. Controller 76 receives incoming signals from codec 86, separates the signals, and passes video 72 and audio 74 to converter 70. Converter 70 performs conversion, if appropriate, and presents incoming conferencing signals to speaker 54 and display 58. Controller 76 may also extract data from the incoming conferencing signals.

In a particular embodiment, real-time video 72 and optionally audio 74 is sent along with corresponding data 82 generated by ATM 78 or POS 80. The term "real-time" means real-time, near real-time, or contemporaneous as possible but subject to limitations in communication systems that cause substantial time to elapse between the capturing of video 72 and data 82 and the display at server 20. In this embodiment, video 72 and optionally audio 74 is sent to controller 76 where it combines with data 82 from ATM 78, POS 80 or any other device that generates data 82 regarding a financial transaction. Alternatively, instead of controller 76, any other device can be used that can combine video 72 and data 82. Data 82 from more than one ATM 78 or POS 80 can be transmitted. Additionally, multiple video windows can be transmitted, each one representing a different camera 56 feed. These types of transmissions can also occur at multiple clients 12. Video 72 is transmitted along with the corresponding data 82 over network 24 via interface 88. Alternatively, data 82 can be stored in database 16 over a period of time. Upon establishment of network connection or some other

occurrence, data 82 is transferred from client 12 to server 20. Server 20 can then query either its own database 18 or database 16 at server 12.

FIGURE 3 illustrates server 20 in more detail. Input/output devices 100 include camera 102, microphone 104, and speaker 106. Input/output devices 100 are coupled to a codec 108, which in turn is coupled to network 24 using an interface 109. A controller 110 is coupled to codec 108, display 112, and input devices 113. Display 112 displays information contained in digital files 14 received from clients 12. In particular, display 112 presents a graphical interface 116 that allows a user of server 20 to display, select, analyze, and report on financial transactions occurring at clients 12 that correspond to digital files 14 maintained in database 18. Also included in database 18 is a data configuration 15 which allows data to be overlaid on display 112 in a variety of formats. Input devices 113 may include a keyboard, mouse, other pointing device, or any other appropriate input device that allows the user to interact with graphical interface 116 and direct the operation of server 20.

Controller 110 is also coupled to database 18, which stores digital files 14 received from clients 12. Alternatively, a video cassette recorder 107 can be used to store real-time video 72. Database 18 includes a database management system 114 that provides traditional database features to store, retrieve, and manipulate information stored as digital files 14 for monitoring, analyzing, and reporting on financial transactions occurring at clients 12. Database management system 114 supports any suitable flat file, hierarchical, relational, object-oriented, or parallel database operation.

In operation, server 20 receives data 82, video 72, and optionally audio 74 in the form of digital files 14 from network 24 using interface 109. Codec 108 decompresses and converts this information into a proper format for storage in database 18 by controller 110. The retrieval of digital files 14 from clients 12 may occur on a periodic basis defined by clients 12, a periodic basis defined by server 20, or as a result of server 20 polling clients 12 with commands to download information.

In response to a request from controller 110, database management system 114 accesses selected digital files 14 and passes this information to controller 110 for presentation by graphical interface 116 on display 112. Using graphical interface 116, the user can display, select, view, analyze, and report on information associated with financial transactions occurring at clients 12.

In an alternative embodiment, server 20 receives data 82 and video 72 from network 24 in real-time. Video 72 is displayed on display 112 based on data configuration 15 stored in database 18. Overlaid as a data window on display 112 is a representation of data 82, such as a cash register receipt. Alternatively, multiple data windows can be displayed corresponding to data 82 from different ATM 78 or POS 80 at the same or different location. Multiple video windows, each one a different video 72 from a different camera 56 at the same or different location can be shown on display 112. Data windows can be displayed for each video 72. A user can switch video 72 based on what is occurring in a data window or views can be switched automatically based on some preexisting criteria. FIGURES 9-11 describe the techniques to display video 72 and data 82 in a variety of arrangements.

Additionally, upon connection between client 12 and server 20, client 12 can automatically transfer data 82 to server 20. This can be all the financial records since last connection, all the financial records over a certain period of time, or some other configuration. Server 20 can then query either its own database 18 or the client's database 16 for further information. Data configuration 15 can control the display of data 82. For example, data configuration 15 can have the display show total sales for a certain time period broken down by categories of items purchased. FIGURE 12 describes in more detail techniques for updating data from a client.

FIGURE 4 illustrates in more detail the components of graphical interface 116. Graphical interface 116 includes a table 120 having a number of entries 122 associated with financial transactions. Each entry 122 includes all or a portion of data 82 generated by POS 78 or ATM 80 at client 12. Highlighted entries 124 may be emphasized by shading, font changes, color differences, or other appropriate technique to indicate the existence of associated video and/or audio. In a particular embodiment, entries 122 correspond to data received from clients 12 operating in a first mode in which digital file 14 includes data 82, and highlighted entries 124 correspond to information retrieved from clients 12 operating in a second mode in which digital file 14 includes data 82, video 72, and optionally audio 74. In this manner, table 120 provides data 82 on associated financial transactions, and also conveys visually those financial transactions associated with particular defined exception conditions 84 at clients 12. Highlighted entries 124 may then be quickly recognized by the user of server 20 and analyzed as a

suspect or more closely monitored financial transaction.

Upon a user selecting highlighted entry 124 using input device 113, video window 126 presents a still frame or a selected portion of partial or full motion video 72 associated with the selected highlighted entry 124. Optional audio 74 may also be presented simultaneously with video 72. The user may manipulate a toolbar 128 to play, pause, stop, fast forward, rewind, adjust the volume, or perform other appropriate functions to analyze video 72 and audio 74 presented by graphical interface 116. Furthermore, video window 126 may present a magnification box 130 that allows the user to analyze selected portions of video 72 in more detail using zoom, pan, and other functions. The storage of vide 72 and audio 74 as digital information enables more sophisticated analysis techniques, such as the techniques provided by toolbar 128 and magnification box 130.

Graphical interface 116 also includes a search/report window 132 that allows the user of server 20 to specify particular financial transactions to view in table 120. For example, search/report window 132 may prompt the user for a number of parameters that specify the desired financial transactions to view. Parameters may include time, date, store identifier, register identifier, amount of transaction, all transactions involving a particular item, all transactions meeting an exception condition, or any other appropriate parameter. Search/report window 132 may also include various printing, reporting, and analyzing capabilities of server 20.

FIGURE 5 illustrates digital file 14 generated by client 12, optionally stored in database 16 at client 12, and stored in database 18 at server 20. Digital file 14 includes data 82 generated by ATM 78 or POS 80

at client 12, video 72, and audio 74. As described above, client 12 operating in a first mode in which exception condition 84 is not met may only include data 82 in digital file 14. However, in a second mode in which exception condition 84 is met, client 12 may include data 82, video 72, and optionally audio 74 in digital file 14.

Data 82 includes a transaction identifier 200, date and time 202, POS or ATM identifier 204, and site identifier 206, which may all be considered together as identifiers 208 that uniquely specify digital file 14 in system 10. Data 82 also includes transaction data 210, that may specify transaction type, item identification, item cost, taxable amount, amount tendered, tax added, total, withdrawal amount, account information, user information, keys depressed at ATM 78 or POS 80 during the financial transaction, or any other data associated with the financial transaction. Controller 76 at client 12 may analyze transaction data 210 to determine if exception condition 84 is met. Data 82 may also include other data 212, such as a measure of the time the cash register door is open, an identifier of the employee on duty, an estimate of the number of persons in the store, or other information not directly related to the financial transaction but provided in data 82 for further analysis of the financial transaction. For clarity, digital file 14 in FIGURE 5 arranges information in blocks. However, data 82, video 72, and audio 74 may be arranged in any format or order, depending upon the particular implementation and technology used in system 10.

The maintenance of data 82, video 72, and audio 74 in a single digital file 14 provides several technical advantages. Digital file 14 may be scrambled, rearranged, encoded, or otherwise processed

to prevent tampering or disassociation of data 82 with its corresponding video 72 and audio 74. In addition, system 10 capitalizes on digital storage, compression, and communications techniques to quickly and efficiently gather digital information at server 20. Also, the digital format of digital file 14 enables more sophisticated database storage, retrieval, and reporting functions to be performed at server 20.

FIGURE 6 illustrates a flow chart of a method of operation of client 12. The method begins at step 300 where the next financial transaction occurs at ATM 78 or POS 80. ATM 78 or POS 80 generate data 82 associated with and upon the occurrence of the financial transaction at step 302. Continuously, upon the occurrence of the financial transaction at step 300, or at any appropriate time, microphone 52 and cameras 56 generate audio/video information associated with financial transaction at step 304. Throughout this description, the term audio/video refers to video alone, audio alone, or both video and audio. If appropriate, converter 70 may generate video 72 and audio 74 for communication to controller 76.

If controller 76 determines that exception condition 84 stored in database 16 is not met at step 306, client 12 enters a first mode and stores digital file 14 including data 82 in database 16 at step 308. If exception condition 84 is met at step 306, client 12 enters a second mode and stores digital file 14 including data 82, video 72, and optionally audio 74 in database 16 at step 310.

If controller 76 detects alarm condition 85 from alarm 83 at step 312, client 12 establishes communication with server 20 or optionally alarm monitoring station 28 at step 314. While client 12 maintains alarm condition 85, client 12 and server 20 or station 28 exchange data, video, and audio at step

316 to implement a one-way or two-way audio/video conferencing link for remote surveillance, management, or supervision. If alarm condition 85 persists at step 318, client 12 and server 20 or station 28 continue to exchange data 82, video 72, and audio 74 at step 316. If alarm condition 85 is over at step 318 and the operation of client 12 is not done at step 320, the method returns to process the next financial transaction at step 300.

If no alarm condition 85 exists at step 312, client 12 determines whether to send digital files 14 to its associated server 20 at step 322. If digital files 14 are to be sent to server 30, client 12 selects digital files 14 to send at step 324. This may be done in response to a command received from server 20 or by specifying locally by client 12 or remotely by server 20 various parameters, such as time, site identifier, register identifier, or other appropriate parameter to select digital files 14. Controller 76 passes selected digital files 14 to codec 86 for formatting at step 326. Interface 88 using network 24 sends digital files 14 to server 20 at step 328. If appropriate, client 12 updates database 16 at step 330, for example, by deleting digital files 14 transmitted to server 20. If the operation of client 12 is not done at 320 or client 12 determines not to send digital files 14 to server 20 at step 322, the method returns to process the next financial transaction at step 300.

FIGURE 7 illustrates a flow chart of a method of operation of server 20. The method begins at step 400 where server 20 receives digital files 14 from associated clients 12. Server 20 stores the received digital files 14 in database 18 at step 402. Dashed feedback arrow 404 indicates that steps 400 and 402 may execute in parallel, in series, in the background,

or in any other appropriate manner to receive digital files 14 from clients 12.

A user of server 20 may input information into search/report window 132 of graphical interface 116 to select digital files 14 stored in database 18 to view at step 406. In response to the user's request, database management system 114 retrieves selected digital files 14 from database 18 and passes this information to controller 110 at step 408. Graphical interface 116 presents data 82 associated with retrieved digital files 14 as entries 122 and 124 in table 120 at step 410. Graphical interface 116 also highlights particular entries 124 with associated video 72 and optional audio 74 at step 412.

Upon selecting particular digital files 14 from database 18 and presenting entries 122 and 124 in table 120, graphical interface 116 of server 20 supports several user functions as illustrated by branch 414. Graphical interface 116 may support these functions in parallel, in serial, or in any other fashion to allow interaction with the user of server 20. If the user selects highlighted entry 124 at step 416, graphical interface 116 presents associated video 72 and audio 74 in video window 126 at step 418. Graphical interface 116 then services functions of toolbox 128 and magnification box 130 at step 420 to allow further analysis of video 72 and audio 74 associated with the selected highlighted entry 124.

If the user selects an analysis or reporting function at step 422, graphical interface 116 services the analysis and reporting function at step 424. For example, the user of server 20 may request summary statistics, print information, run predefined reports, or perform any other function on data 82 displayed in table 120 or maintained as digital files 14 in database 18. Graphical interface 116 outputs the

results of the analysis and reporting functions at step 426.

The user may also request a new table at step 428 by submitting another query in search/report window 132. In response, the method continues at step 406 where server 20 selects digital files 14 to view. If the operation of server 20 is not done at step 430, server 20 continues to receive digital files 14 at step 400 and store digital files 14 in database 18 at step 402.

FIGURE 8 illustrates a video surveillance system 10 capable of real-time transmission of video 72 and data 82. Clients 12 are coupled to servers 20 via a communication network 24 as previously discussed in conjunction with FIGURE 1. Each server 20 includes display 112 which is capable of displaying real-time video 72 and data 82 received from client 12. In this embodiment, video 72 is sent by client 12 over connection 24 as soon as it is captured by camera 56. This is called real-time video, although it is understood that the limits of communication network 24 and other components of surveillance system 10 may introduce an appreciable delay between the capturing of video 72 and its display at server 20. Data 82 corresponding to video 72 is also sent along network 24. Additional data 82 from other sources at that location can be sent along network 24 as can additional video 72 from other cameras.

FIGURE 9 illustrates display 112 which includes video window 126 and one or more data windows 127. Data window 127 represents an overlay of data 82 from ATM 78 or POS 80 or any other device capable of producing data 82 generated by a financial transaction. For example, data window 127 may represent a live or scrolling version of a cash register receipt corresponding to the image of a

customer purchasing goods in a store in video windows 126. Multiple data windows 127 can be overlaid on a video window 126, each corresponding to an ATM 78 or POS 80 at the same or different location. An operator at server 20 can switch video 72 corresponding to a particular data window 127 or the switching can be done periodically or automatically, based on a variety of criteria such as an alarm condition or preprogramed response. These include switching to video 72 based on data 82 (e.g., the presence of data 82, amount of money spent, key depressions at ATM 78 or POS 80, etc.), type of item purchased, movement in a video window, sound levels, or any other suitable criteria. Server 20 may switch, arrange, or display video window 126 and/or data window 127 in response to these criteria.

FIGURE 10 illustrates a display 112 divided into multiple video windows 126. These video windows 126 can be from cameras 56 at the same or different locations. Data windows 127 are overlaid in each video window 126. Multiple data windows 127 can be displayed in a given video window 126 as discussed in FIGURE 9. Multiple video windows 126 and data windows 127 may be repositioned, resized, or otherwise manipulated or arranged in response to criteria discussed above with reference to FIGURE 9.

FIGURE 11 is a flowchart of real-time video 72 and data 82 transmission. In step 500, client 12 generates data 82 from a financial transaction at ATM 78 or POS 80 or other device. Client 12 also generates video 72 corresponding to data 82 at step 502. Client 12 transmits video 72 and data 82 over network 24 to server 20 in step 504. Video 72 and data 82 are communicated in real-time and can be from multiple sources. In step 506, data is overlaid as a data window 127 with video 72 on display 112. Server

20 overlays a single or multiple data windows 127 on a single or multiple video window 126 in any appropriate configuration as discussed above with reference to FIGURE 9 and 10. Step 508 determines if a change to a display needs to be made based on a variety of criteria. Manual changes, such as those initiated by an operator, are covered in step 510. These would include an operator switching to a window based on a transaction appearing in a data window or an operator switching camera views as part of a normal scan pattern. In step 512, server 20 automatically configures windows based on changes in video 72. For example, sudden movement may trigger a video window to appear. Also, if a camera becomes obstructed, a change in a video window might be triggered. In step 514, display 112 automatically changes due to the presence or content of data 82, such as the amount of purchase, the type of purchase, some alarm condition, keystrokes, or other criteria.

FIGURE 12 is a flowchart for a method of updating data 82 from client 12. In step 520, a link between client 12 and server 20 is established. This step can involve the actual establishment of a link over network 24, the restoring of a paused link, initializing the update procedure over an already established link, or some other connection criteria or prearranged transfer time. In step 522, client 12 communicates data to server 20. This data 82 can contain register or item totals for a given time period, a running total since last connection, the total number of certain items sold, raw inventory or transaction data, or any other numeric or alphanumeric data that conveys information on the activity at client 12. Data 82 is typically stored in a file at client 12 and information gathered over a period of

time is accumulated in that file. This file can be stored at server 20 upon receipt.

In step 524 server 20 displays data 82 in a format determined by data configuration file 15 stored in database 18. The display format may specify grand totals, sales on items of interest, inventory, cash on hand, or some other information. Configuration file 15 may be stored as an initialization file or some type of configuration file. Configuration file 15 is designed to be updated easily to allow displays to be designed efficiently. Server 20 maintains multiple configuration files 15 based on client 12, the identity of the operator at client 12, the identity of the operator at server 20, a time measure (e.g., time of day, day of the week, day of the month, quarter, etc.), a particular report format, or any other appropriate criteria.

In step 526, the process determines if additional queries need to be made. Additional queries can be made to extract data not transferred or to display data in an alternative format. If so, step 528 determines if the queries are to be made locally, that is, at the server. If so, server 20 performs queries on the server's database 18 in step 530. If not, server 20 performs queries on the client's database 16 in step 532.

Although the present invention has been described in several embodiments, a myriad of changes, variations, alterations, transformations, and modifications may be suggested to one skilled in the art, and it is intended that the present invention encompass such changes, variations, alterations, transformations, and modifications as fall within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A video surveillance system, comprising:

a client operable to generate data associated with a financial transaction, the client having a camera operable to generate video associated with the financial transaction, the client operable to store data and video in a digital file; and

a server coupled to the client using a communications network, the server operable to receive the digital file from the client and to store the digital file in a memory, the server having a graphical interface operable to retrieve data and video from the digital file stored in the memory for presentation.

2. The system of Claim 1, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

3. The system of Claim 1, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

4. The system of Claim 1, wherein the client comprises a microphone operable to generate audio associated with the financial transaction, the client operable to store data, video, and audio in the digital file.

5. The system of Claim 1, wherein the digital file comprises a single multimedia digital file.

6. The system of Claim 1, wherein:

the graphical interface at the server presents data as an entry in a table having a plurality of entries associated with a plurality of financial transactions; and

the graphical interface at the server presents video in response to a selection of the entry in the table.

7. The system of Claim 1, wherein the graphical interface at the server presents data as an entry in a table having a plurality of entries associated with a plurality of financial transactions, at least one entry highlighted to indicate the existence of video associated with the entry.

8. The system of Claim 1, wherein:

the client comprises a microphone, a speaker, and a display;

the server comprises a camera, a microphone, a speaker, and a display; and

the client and the server are further operable to conduct two-way audio/video conferencing.

9. The system of Claim 1, wherein the client has a first mode and a second mode of operation, the client in the first mode includes data in the digital file, the client in the second mode includes data and video in the digital file, the second mode associated with an exception condition of the financial transaction.

10. The system of Claim 9, wherein the server transmits information to the client to define the exception condition.

11. A video surveillance method, comprising:

generating data associated with a financial transaction;

generating video associated with the financial transaction;

storing data and video in a digital file at a client;

receiving the digital file at a server using a communications network;

storing the digital file at the server; and

presenting data and video in the digital file using a graphical interface.

12. The method of Claim 11, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

13. The method of Claim 11, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

14. The method of Claim 11, further comprising the steps of:

generating audio associated with the financial transaction; and

storing the audio in the digital file at the client.

15. The method of Claim 11, wherein the digital file comprises a single multimedia digital file.

16. The method of Claim 11, wherein the step of presenting comprises:

presenting data as an entry in a table having a plurality of entries associated with a plurality of financial transactions;

receiving a selection of the entry in the table; and

presenting video associated with the data in response to the selection of the entry in the table.

17. The method of Claim 11, wherein the step of presenting comprises:

presenting data as an entry in a table having a plurality of entries associated with a plurality of financial transactions;

highlighting the entry to indicate the existence of video associated with the data; and

presenting video associated with the data in response to the selection of the highlighted entry.

18. The method of Claim 11, wherein the step of storing data and video at the client comprises:

storing data in a first mode; and

storing data and video in a second mode associated with an exception condition of the financial transaction.

19. The method of Claim 18, further comprising the step of communicating information from the server to the client to define the exception condition of the financial transaction.

20. The method of Claim 18, wherein:

the client comprises a point-of-sale device and the financial transaction comprises the sale of an item; and

the exception condition comprises the activation of one of a selected no sale and void keys on the point-of-sale device.

21. A video surveillance system, comprising:

a client operable to generate data associated with at least one financial transaction, the client having a camera operable to generate video associated with the financial transaction, the client operable to transmit the data and video using a communications network; and

a server coupled to the client using the communications network, the server operable to receive the data and video from the client and to display the video and data in real-time.

22. The system of Claim 21, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

23. The system of Claim 21, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

24. The system of Claim 21, wherein the client comprises a microphone operable to generate audio associated with the financial transaction, the client operable to transmit data, video, and audio over the communications network.

25. The system of Claim 21, wherein the server forms a data window from the data and a video window from the video and overlays the data window on the video window.

26. The system of Claim 21, wherein the server presents data from a plurality of financial transactions as a plurality of data windows, presents video from a plurality of video sources as a plurality of video windows, and associates the data windows with the corresponding video windows.

27. The system of Claim 26, wherein the server receives user input to specify one of the data windows to display the video window associated with the specified data window.

28. The system of Claim 26, wherein the server associated with the financial transaction automatically switches the video window to the video associated with the data in response to the presence or content of data.

29. The system of Claim 26, wherein the server displays the appropriate video window and data window upon changes in one of the plurality of video windows.

30. The system of Claim 21, wherein the client stores accumulated data associated with the financial transaction and transmits the data when the client communicates with the server.

31. A video surveillance method, comprising:

generating data associated with a financial transaction;

generating video associated with the financial transaction;

transmitting data and video in real-time from a client;

receiving the data and video at a server using a communications network; and

presenting data and video on a display at the server.

32. The method of Claim 31, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

33. The method of Claim 31, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

34. The method of Claim 31, further comprising the steps of:

generating audio associated with the financial transaction; and

transmitting the audio to the server.

35. The method of Claim 31, wherein the step of presenting comprises:

presenting data in a data window as a representation of the financial transaction;

presenting video in a video window; and

overlaying the data window on the video window.

36. The method of Claim 31, wherein the step of presenting comprises:

presenting data as a plurality of data windows associated with a plurality of financial transactions;

presenting video as a plurality of video windows associated with a plurality of video sources; and

associating the data window with the corresponding video window.

37. The method of Claim 36, further comprising the step of updating the video window and the data window in response to the presence or content of the data in one of the plurality of data windows.

38. The method of Claim 36, further comprising the step of updating the video window and the data window in response to a change in one of the plurality of video windows.

39. The method of Claim 36, further comprising the steps of:

receiving a user selection; and

updating the video window and the data window in response to the selection.

40. The method of Claim 31, further comprising the steps of:

storing accumulated financial data in a file at the client;

transmitting the file from the client to the server upon connection of the client to the server.

41. The method of Claim 30, wherein the digital file contains financial records accumulated since last connection.

42. A video surveillance system, comprising:

a client operable to generate data associated with a financial transaction and to accumulate and store the data as a digital file, the client having a camera operable to generate video associated with the financial transaction, the client operable to transmit the data and video across a communications network; and

a server coupled to the client using the communications network, the server operable to receive the digital file upon connection with the client, to receive the data and video from the client and to display the video and data in real-time.

43. The system of Claim 42, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

44. The system of Claim 42, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

45. The system of Claim 42, wherein the client comprises a microphone operable to generate audio associated with the financial transaction, the client operable to transmit data, video, and audio over the communications network.

46. The system of Claim 42, wherein the server forms a data window from the data and a video window from the video and overlays the data window on the video window.

47. The system of Claim 42, wherein the server presents data from a plurality of financial transactions as a plurality of data windows, presents video from a plurality of video sources as a plurality of video windows, and associates the data windows with the corresponding video windows.

48. The system of Claim 47, wherein the server receives user input to specify one of the data windows to display the video window associated with the specified data window.

49. The system of Claim 47, wherein the server associated with the financial transaction automatically switches the video window to the video associated with the data in response to the presence or content of data.

50. The system of Claim 47, wherein the server displays the appropriate video window and data window upon changes in one of the plurality of video windows.

51. The system of Claim 42, wherein the client stores accumulated data associated with the financial transaction and transmits the data when the client communicates with the server.

52. The system of Claim 42, wherein the server displays the digital file based on a configuration file.

53. A video surveillance method, comprising:

generating data associated with a financial transaction;

generating video associated with the financial transaction;

storing accumulated data as a digital file;

transmitting the digital file upon connection of the client and the server;

transmitting data and video in real-time from a client;

receiving the data and video at a server using a communications network; and

presenting data and video on a display at the server.

54. The method of Claim 53, wherein the client comprises a point-of-sale device and the financial transaction comprises the sale of an item.

55. The method of Claim 53, wherein the client comprises an automated teller machine and the financial transaction comprises a cash withdrawal.

56. The method of Claim 53, further comprising the steps of:

generating audio associated with the financial transaction; and

transmitting the audio to the server.

57. The method of Claim 53, wherein the step of presenting comprises:

presenting data in a data window as a representation of the financial transaction;

presenting video in a video window; and

overlaying the data window on the video window.

58. The method of Claim 53, wherein the step of presenting comprises:

presenting data as a plurality of data windows associated with a plurality of financial transactions on a display at the server;

presenting video as a plurality of video windows associated with a plurality of video sources on a display at the server; and

associating the data window with the corresponding video window.

59. The method of Claim 58, further comprising the step of updating the video window and the data window in response to the presence or content of the data in one of the plurality of data windows.

60. The method of Claim 58, further comprising the step of updating the video window and the data window in response to a change in one of the plurality of video windows.

61. The method of Claim 58, further comprising the steps of:

receiving a user selection; and

updating the video window and the data window in response to the selection.

62. The method of Claim 53, wherein the digital file contains financial records accumulated since last connection.

FIG. 1

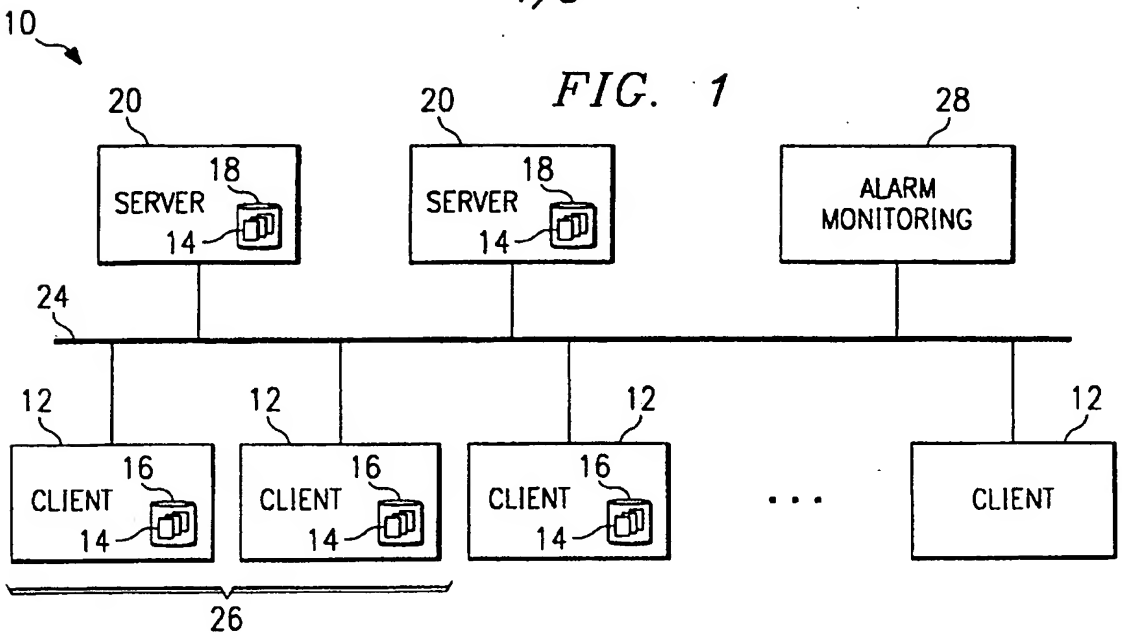
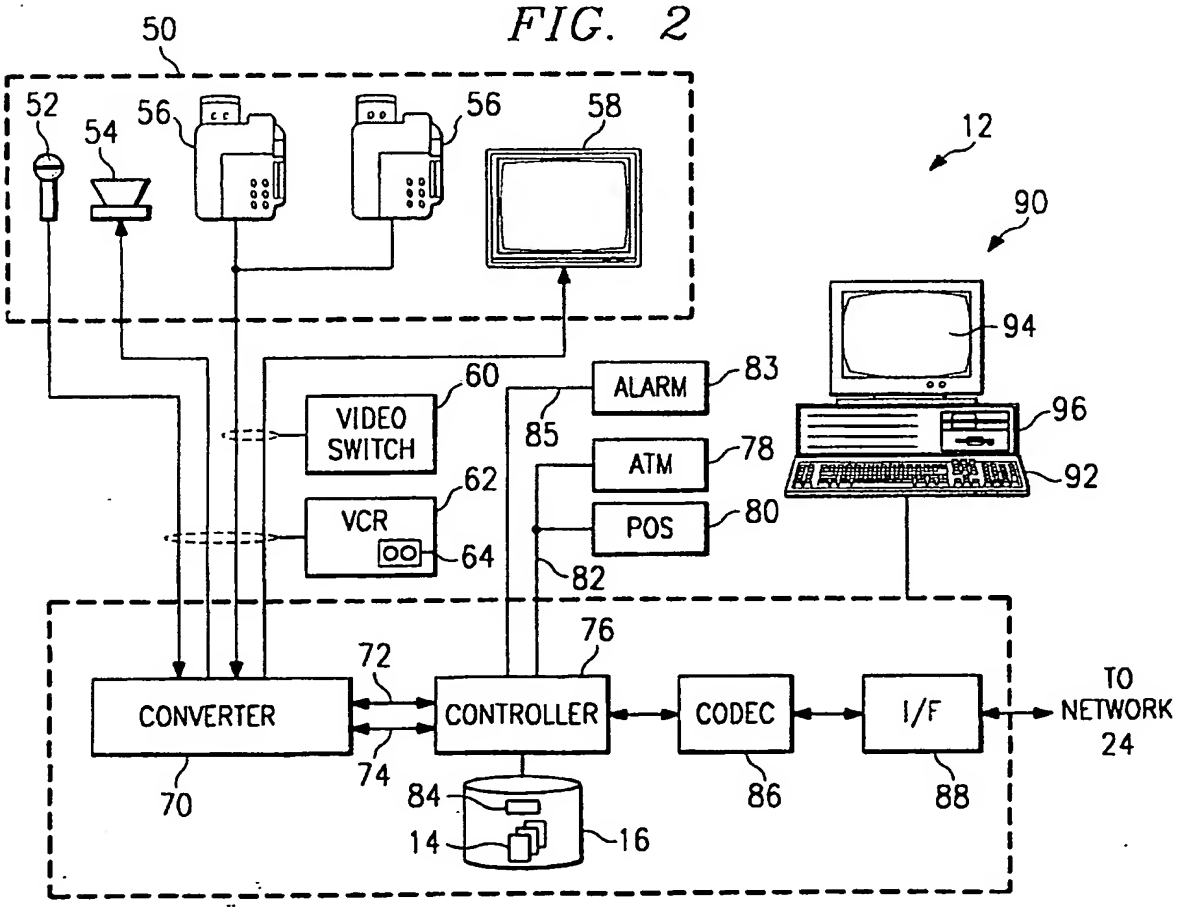

10
20
20
28
SERVER
18
14
SERVER
18
14
ALARM MONITORING
24
12
12
12
12
CLIENT
16
14
CLIENT
16
14
CLIENT
16
14
CLIENT
26

FIG. 2


50
52
54
56
56
58
12
90
94
96
92
60
VIDEO SWITCH
62
VCR
64
ALARM
83
85
ATM
78
POS
80
82
72
76
CONVERTER
CONTROLLER
CODEC
I/F
TO NETWORK 24
74
70
84
14
16
86
88

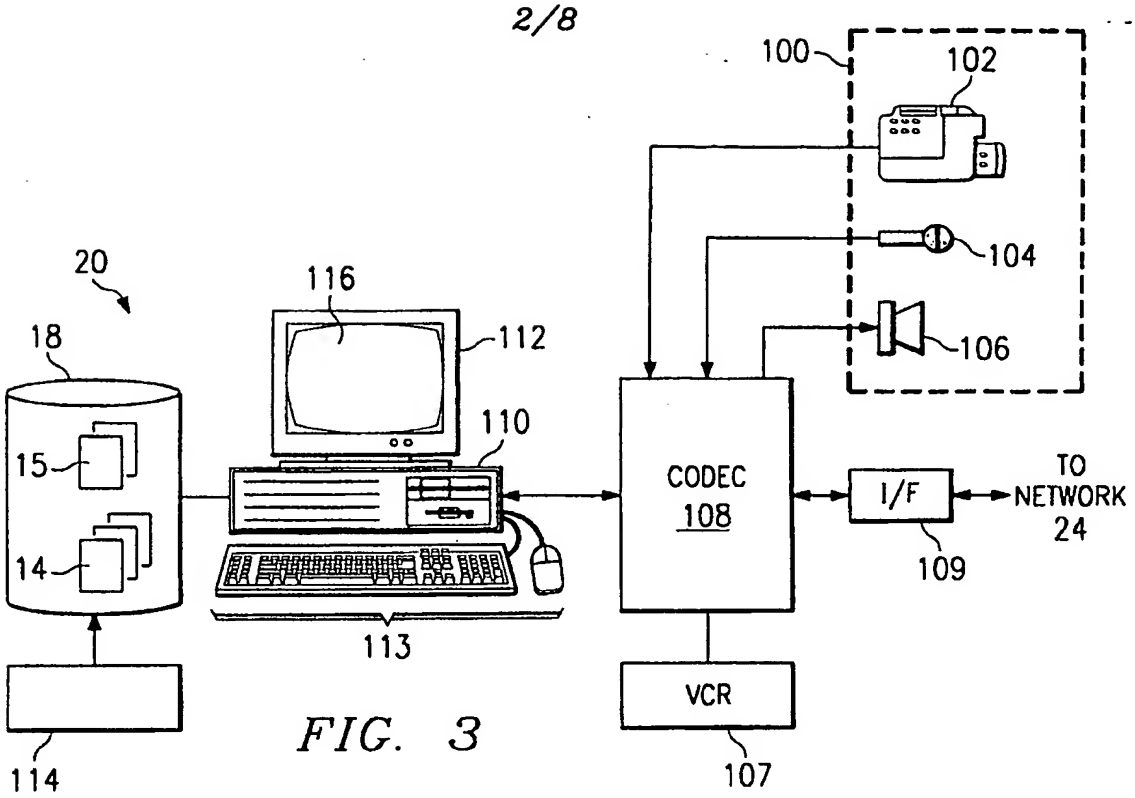

100
102
104
106
20
116
18
112
110
15
14
CODEC
108
I/F
TO
NETWORK
24
109
113
VCR
114
107

FIG. 3

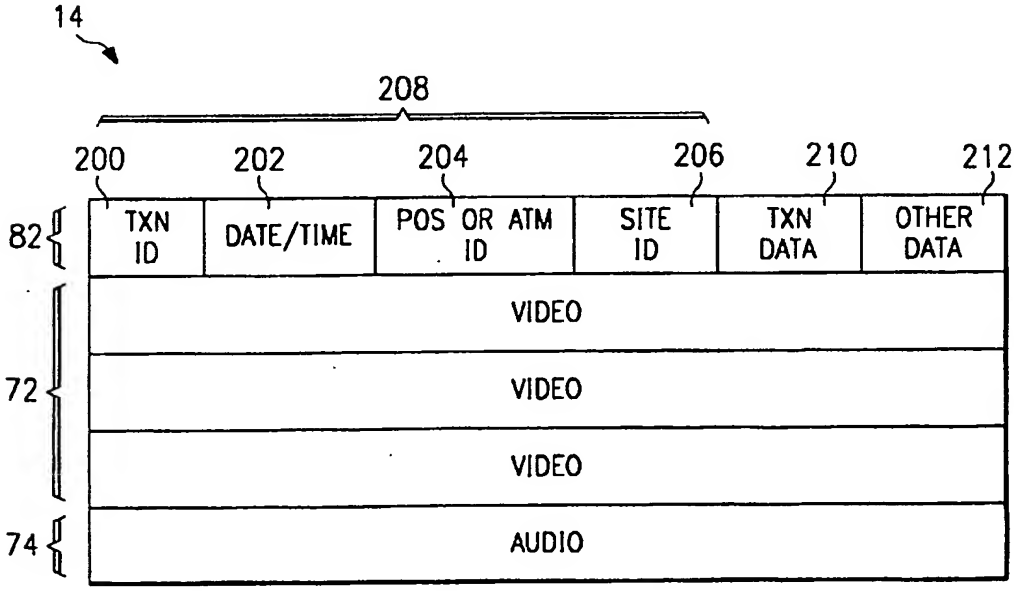
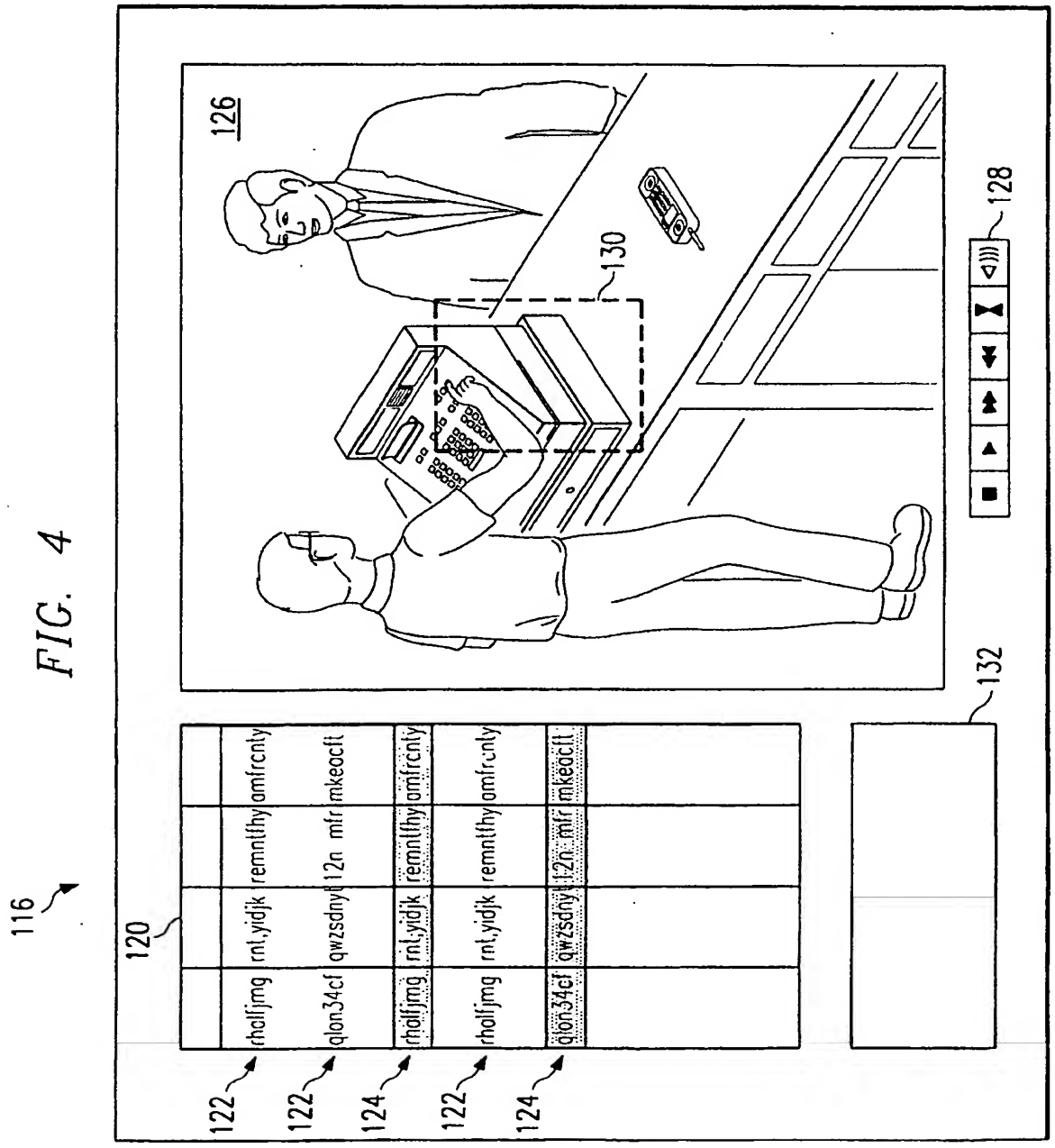

14
208
200
202
204
206
210
212
82
TXN ID
DATE/TIME
POS OR ATM ID
SITE ID
TXN DATA
OTHER DATA
72
VIDEO
VIDEO
VIDEO
74
AUDIO

FIG. 5

FIG. 4


116
120
122
122
124
122
124
126
130
128
132
rhalfjmg rnl,yidjk remntfhy amfrcnly
qlon34cf qwzsdnyl 12n mfr mkeocft
rhalfjmg rnl,yidjk remntfhy amfrcnly
rhalfjmg rnl,yidjk remntfhy amfrcnly
qlon34cf qwzsdnyl 12n mfr mkeocft

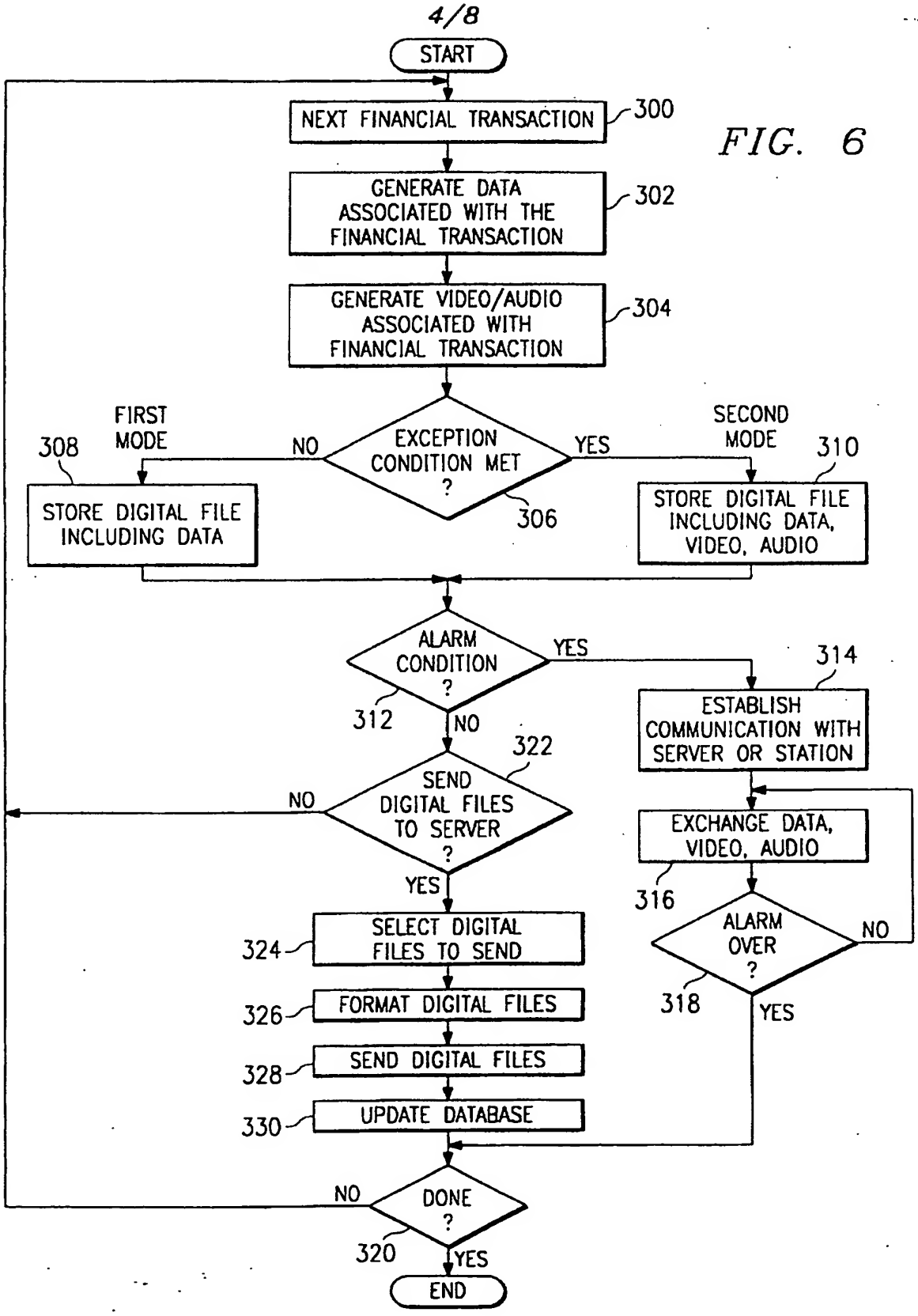

START
NEXT FINANCIAL TRANSACTION
300
GENERATE DATA ASSOCIATED WITH THE FINANCIAL TRANSACTION
302
GENERATE VIDEO/AUDIO ASSOCIATED WITH FINANCIAL TRANSACTION
304
EXCEPTION CONDITION MET ?
306
NO
YES
FIRST MODE
308
STORE DIGITAL FILE INCLUDING DATA
SECOND MODE
310
STORE DIGITAL FILE INCLUDING DATA, VIDEO, AUDIO
ALARM CONDITION ?
312
YES
NO
314
ESTABLISH COMMUNICATION WITH SERVER OR STATION
EXCHANGE DATA, VIDEO, AUDIO
316
ALARM OVER ?
318
NO
YES
SEND DIGITAL FILES TO SERVER ?
322
NO
YES
SELECT DIGITAL FILES TO SEND
324
FORMAT DIGITAL FILES
326
SEND DIGITAL FILES
328
UPDATE DATABASE
330
DONE ?
320
NO
YES
END

FIG. 6

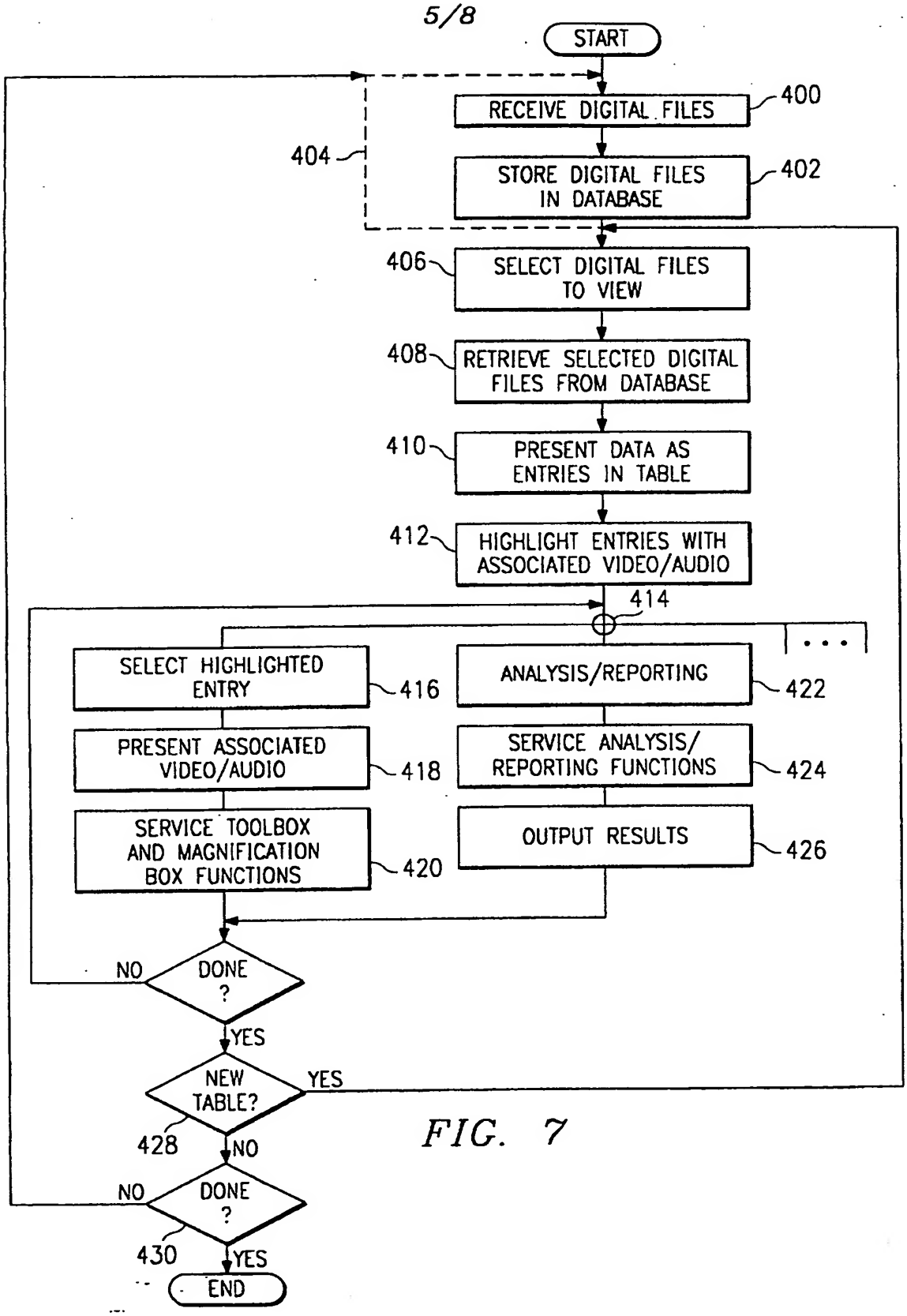

START
RECEIVE DIGITAL FILES
400
404
STORE DIGITAL FILES IN DATABASE
402
406
SELECT DIGITAL FILES TO VIEW
408
RETRIEVE SELECTED DIGITAL FILES FROM DATABASE
410
PRESENT DATA AS ENTRIES IN TABLE
412
HIGHLIGHT ENTRIES WITH ASSOCIATED VIDEO/AUDIO
414
SELECT HIGHLIGHTED ENTRY
416
PRESENT ASSOCIATED VIDEO/AUDIO
418
SERVICE TOOLBOX AND MAGNIFICATION BOX FUNCTIONS
420
ANALYSIS/REPORTING
422
SERVICE ANALYSIS/ REPORTING FUNCTIONS
424
OUTPUT RESULTS
426
NO
DONE ?
YES
NEW TABLE?
YES
428
NO
NO
DONE ?
430
YES
END

FIG. 7

FIG. 8

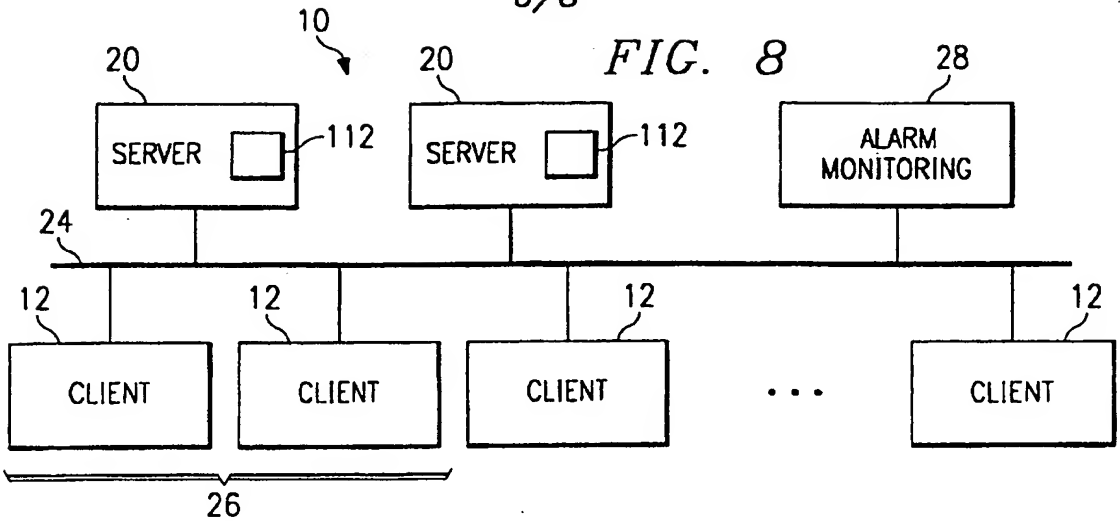
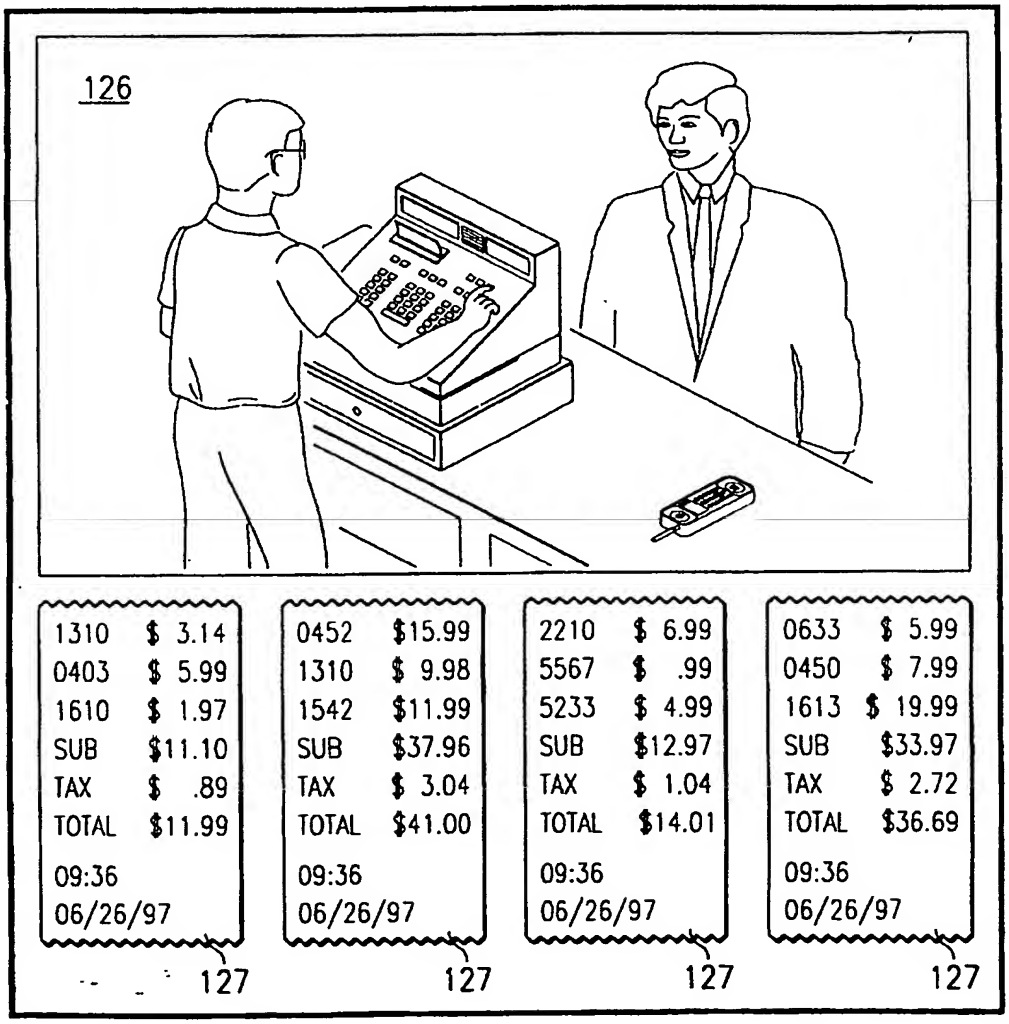

10
20
20
28
SERVER
112
SERVER
112
ALARM MONITORING
24
12
12
12
12
CLIENT
CLIENT
CLIENT
CLIENT
26

FIG. 9


112
126
1310 $ 3.14
0403 $ 5.99
1610 $ 1.97
SUB $11.10
TAX $ .89
TOTAL $11.99
09:36
06/26/97
0452 $15.99
1310 $ 9.98
1542 $11.99
SUB $37.96
TAX $ 3.04
TOTAL $41.00
09:36
06/26/97
2210 $ 6.99
5567 $ .99
5233 $ 4.99
SUB $12.97
TAX $ 1.04
TOTAL $14.01
09:36
06/26/97
0633 $ 5.99
0450 $ 7.99
1613 $ 19.99
SUB $33.97
TAX $ 2.72
TOTAL $36.69
09:36
06/26/97
127
127
127
127

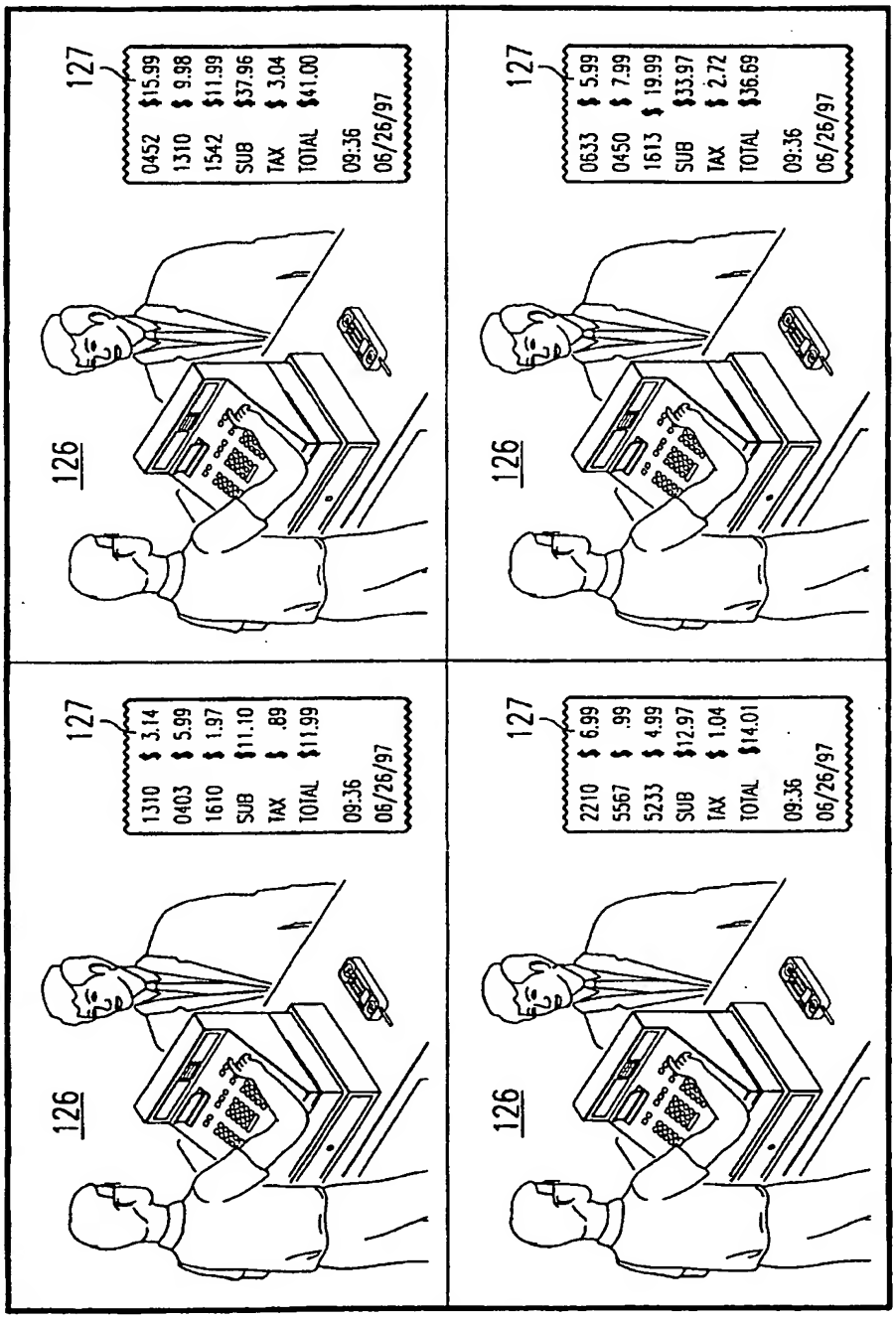
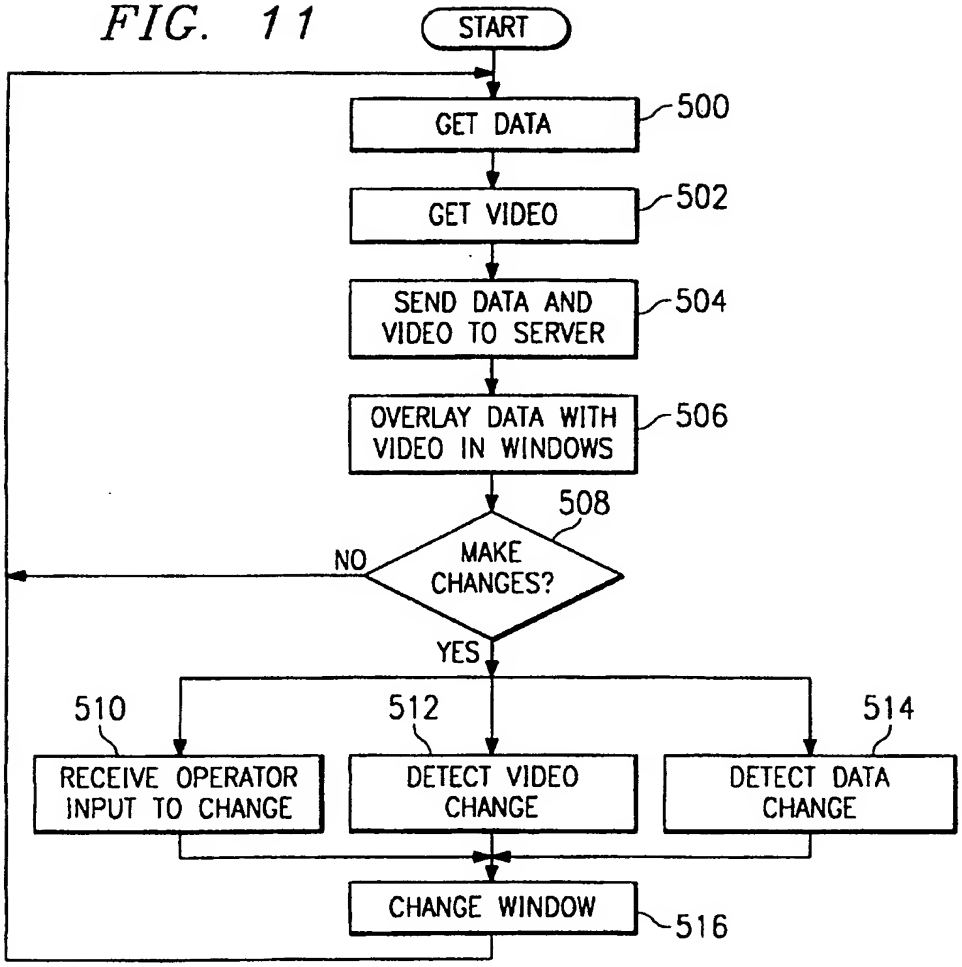

112
126
127
1310 $ 3.14
0403 $ 5.99
1610 $ 1.97
SUB $11.10
TAX $ .89
TOTAL $11.99
09:36
06/26/97
126
127
0452 $15.99
1310 $ 9.98
1542 $11.99
SUB $37.96
TAX $ 3.04
TOTAL $41.00
09:36
06/26/97
126
127
2210 $ 6.99
5567 $ .99
5233 $ 4.99
SUB $12.97
TAX $ 1.04
TOTAL $14.01
09:36
06/26/97
126
127
0633 $ 5.99
0450 $ 7.99
1613 $ 19.99
SUB $33.97
TAX $ 2.72
TOTAL $36.69
09:36
06/26/97

FIG. 10

FIG. 11


START
GET DATA
500
GET VIDEO
502
SEND DATA AND VIDEO TO SERVER
504
OVERLAY DATA WITH VIDEO IN WINDOWS
506
508
MAKE CHANGES?
NO
YES
510
512
514
RECEIVE OPERATOR INPUT TO CHANGE
DETECT VIDEO CHANGE
DETECT DATA CHANGE
CHANGE WINDOW
516

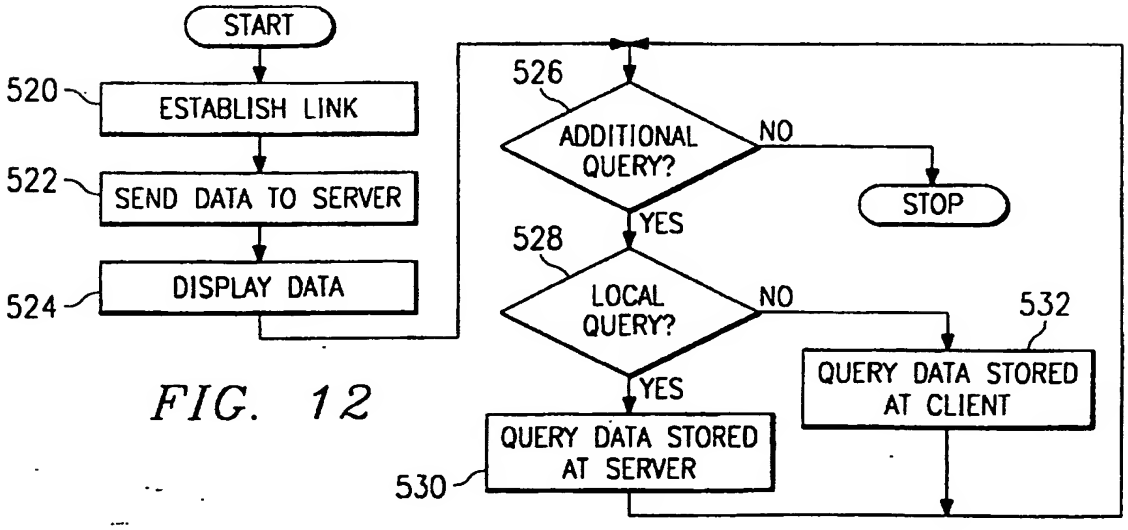

START
520
ESTABLISH LINK
522
SEND DATA TO SERVER
524
DISPLAY DATA
526
ADDITIONAL QUERY?
NO
STOP
YES
528
LOCAL QUERY?
NO
532
QUERY DATA STORED AT CLIENT
YES
QUERY DATA STORED AT SERVER
530

FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/12000

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G08B15/00 G07F7/10 G07G3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G07F G07G G08B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 663 655 A (INTEGRATED SECURITY) 19 July 1995	1,2,11, 12,21, 22,25, 26,31, 32,35,36
Y	see page 10, line 42 - page 11, line 32; figures 1-4	3-5, 13-15, 23,24, 33,34, 45,56
A		6-9, 16-18, 20, 27-30, 34, 37-44, 46-55, 57-62
	--- -/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1997	05. 12. 97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Neville, D

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/12000

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 661 677 A (EASTMAN KODAK) 5 July 1995	3,13,23, 33
A	see column 3, line 40 - line 57; figure 1	1,11,18, 19,21, 24,30, 40-42, 44,45, 51,53, 55,62

Y	US 4 054 752 A (DENNIS, JR. ET AL.) 18 October 1977	4,5,14, 15,24, 34,45,56
A	see column 6, line 46 - line 62; figures 1,4	1,2,8, 11,12, 20-22, 31,32, 42,43, 53,54

X	US 4 991 008 A (NAMA) 5 February 1991	21-23, 25, 31-33,35
	see column 6, line 25 - line 66; figure 1 see column 9, line 5 - line 46; figure 3	
A	see column 11, line 32 - column 12, line 2; figure 4	1-3,8, 11-13, 19,20, 24,30, 40-46, 51, 53-55, 57,62

A	EP 0 332 161 A (ROBOTFOTO & ELECTRONIC) 13 September 1989	1,3,9, 11,13, 18,21, 23,30, 31,33, 40-42, 44,51, 53,55,62
	see column 2, line 45 - column 3, line 7; figure 2	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 97/12000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 663655 A	19-07-95	US 5216502 A	01-06-93
		AT 127601 T	15-09-95
		AU 660005 B	08-06-95
		AU 9166391 A	22-07-92
		CA 2098596 A	19-06-92
		DE 69112842 D	12-10-95
		DE 69112842 T	04-04-96
		DE 563303 T	17-03-94
		EP 0563303 A	06-10-93
		ES 2077396 T	16-11-95
		JP 6503437 T	14-04-94
		OA 9781 A	15-04-94
		WO 9211614 A	09-07-92
EP 661677 A	05-07-95	JP 7234958 A	05-09-95
US 4054752 A	18-10-77	NONE	
US 4991008 A	05-02-91	NONE	
EP 332161 A	13-09-89	DE 3807727 A	21-09-89
		CA 1323086 A	12-10-93
		JP 1296398 A	29-11-89
		US 4942464 A	17-07-90

19. The apparatus as claimed in claim 1 wherein the objects clustering application layer generates at least one new or updated object from the difference image and an at least one existing object.

20. The apparatus of claim 1 wherein the object tracking program further comprises a scene characterization application layer for describing the scene and for triggering an alarm, based on comparing a behavior pattern of the at least one existing object to the at least one pre-defined behavior pattern or characteristic.

21. The apparatus as claimed in claim 20 wherein the scene characterization application layer comprises an object movement measurement module for analyzing changes in the parameters of the at least one existing object and determining the at least one existing object movement.

22. The apparatus as claimed in claim 20 wherein the scene characterization application layer comprises an object merger module for correcting errors the at least one existing object and an alarm triggering mechanism for determining whether an alarm is to be triggered based on the at least one existing object patterns.

23. The apparatus claimed in claim 1 wherein the background update application layer comprises a background draft updater module for updating the at least one reference image from the currently captured video frame.

24. The apparatus claimed in claim 23 wherein the background update application layer further comprises a short term reference image updater module and a long term reference image updater module for maintaining the updated short term and long term reference images.

25. The apparatus claimed in claim 1 further comprising an object tracking control database, the database comprising;

at least one long term reference image, the at least one long term reference image comprising a background image of the scene without dynamic or static objects tracked by the apparatus;

a short term reference image, the at least one short term reference image comprising a background image of the scene with the dynamic or static objects tracked by the apparatus.

26. The apparatus claimed in claim 25 wherein the object tracking control database further comprising;

an objects table comprising a list of the dynamic or static objects tracked by the apparatus, each object is associated with object data and object meta data; and

a distance short term map and a distance long term map showing the short-term and long-term reference images; and

a background draft comprising a changing image of the scene and making up the reference image.

27. The apparatus claimed in claim 26 wherein the object tracking control database further comprising a discarded objects archive for storing discarded objects.

28. A method for the analysis of a sequence of captured images showing a scene for detecting and tracking of at least one moving or static object and for matching the patterns of the at least one object behavior in the captured images to object behavior in predetermined scenarios, the method comprising the step of:

capturing at least one image of the scene;

pre-processing the captured at least one image and generating a short term difference image and a long term difference image;

clustering the at least one moving or static object in the short term difference and long term difference images and generating at least one new object and at least one existing object.

29. The method as claimed in claim 28 further comprising the steps of characterizing the visual scene and updating the background reference image by updating the short term reference frame and the long term reference frame.

30. The method as claimed in claim 28 further comprising the step of configuring the object tracking program for providing at least one reference image, at least one timing parameter and at least one visual parameter.

31. The method as claimed in claim 28 further comprising the step of configuring the object tracking program for setting at least one region of interest.

32. The method as claimed in claim 28 further comprising the step of configuring the object tracking program, said step comprises the steps of:

constructing an initial short term reference image and an initial long term reference image;

providing the object tracking program with the initial short term reference image and the initial long term reference image;

providing timing parameters; and assigning visual parameters.

33. The method as claimed in claim 32 wherein the step of constructing comprises creating the short term reference image and the long term reference image from a captured image.

34. The method as claimed in claim 32 wherein the step of constructing comprises creating the short term reference image and the long term reference image from internally stored images.

35. The method as claimed in claim 32 wherein the step of constructing comprises creating the short term reference image and the long term reference image through a learning process utilizing a set of sequentially ordered and captured images.

36. The method as claimed in claim 28 wherein the step pf pre-processing comprises the steps of:

obtaining the short term reference image;

obtaining the long term reference image;

obtaining a currently captured image;

generating a short term difference image from the short term reference frame and the currently captured image;

generating a long term difference image from the long term reference frame and the currently captured image.

37. The method as claimed in claim 28 wherein the step of clustering comprises the steps of:

building groups of clustered objects from at least two dynamic or static objects in accordance with the relative locations of each of the at least two dynamic or static objects;

adjusting the parameters of each of the at least two dynamic or static objects clustered within each group;

updating the parameters and status of each of the at least two dynamic or static objects.

38. The method of claim 28 wherein the step of clustering comprises the steps of predicting the motion of the at least one moving object by predictive filtering and adapting the parameters of the at least one moving object.

39. The method as claimed in claim 37 wherein the step of building groups of clustered objects comprises the steps of:

measuring the distance between each of the at least two dynamic or static objects;

determining neighborhood relations between each of the at least two dynamic or static objects and in accordance with the results of the distance measurement;

clustering the at least two dynamic or static objects in accordance with the determined neighborhood relations into distinct object groups; and

adjusting the distinct object groups in order to determine the optimal spatial parameters of each of the at least two dynamic or static objects in the distinct object groups.

40. The method as claimed in claim 38 wherein the step of adapting the parameters of the at least one moving object comprises the steps of locating the center of the at least one moving object; locating the boundary points constituting the boundary line of the at least one moving object; re-calculating the location of the center of the at least one moving object; and inserting the at least one moving object into an objects table.

41. The method as claimed in claim 40 further comprising the steps of adjusting the spatial parameters of the at least one moving object and retrieving similar objects to the at least one moving object from a discarded object archive.

42. The method as claimed in claim 29 wherein the step of characterizing comprises the steps of: measuring the movement of the at least one moving object to determine the behavior of the at least one moving object; merging spatially overlapping objects; generate an alarm trigger in accordance with the results of the behavior of the at least one moving object or in accordance with the spatial or visual parameters of the at least one moving object.

43. The method as claimed in claim 42 wherein the alarm trigger is generated in accordance with the texture of the object.

44. The method as claimed in claim 42 wherein the alarm trigger is generated in accordance with the shape of the object,

45. The method as claimed in claim 42 wherein the alarm trigger is generated in accordance with the velocity of the at least one moving object.

46. The method as claimed in claim 42 wherein the alarm trigger is generated in accordance with the trajectory of the at least one moving object.

47. The method as claimed in claim 28 wherein the step of updating the background comprises the steps of: updating the background draft;

updating the short term reference image; and updating the long term reference image.

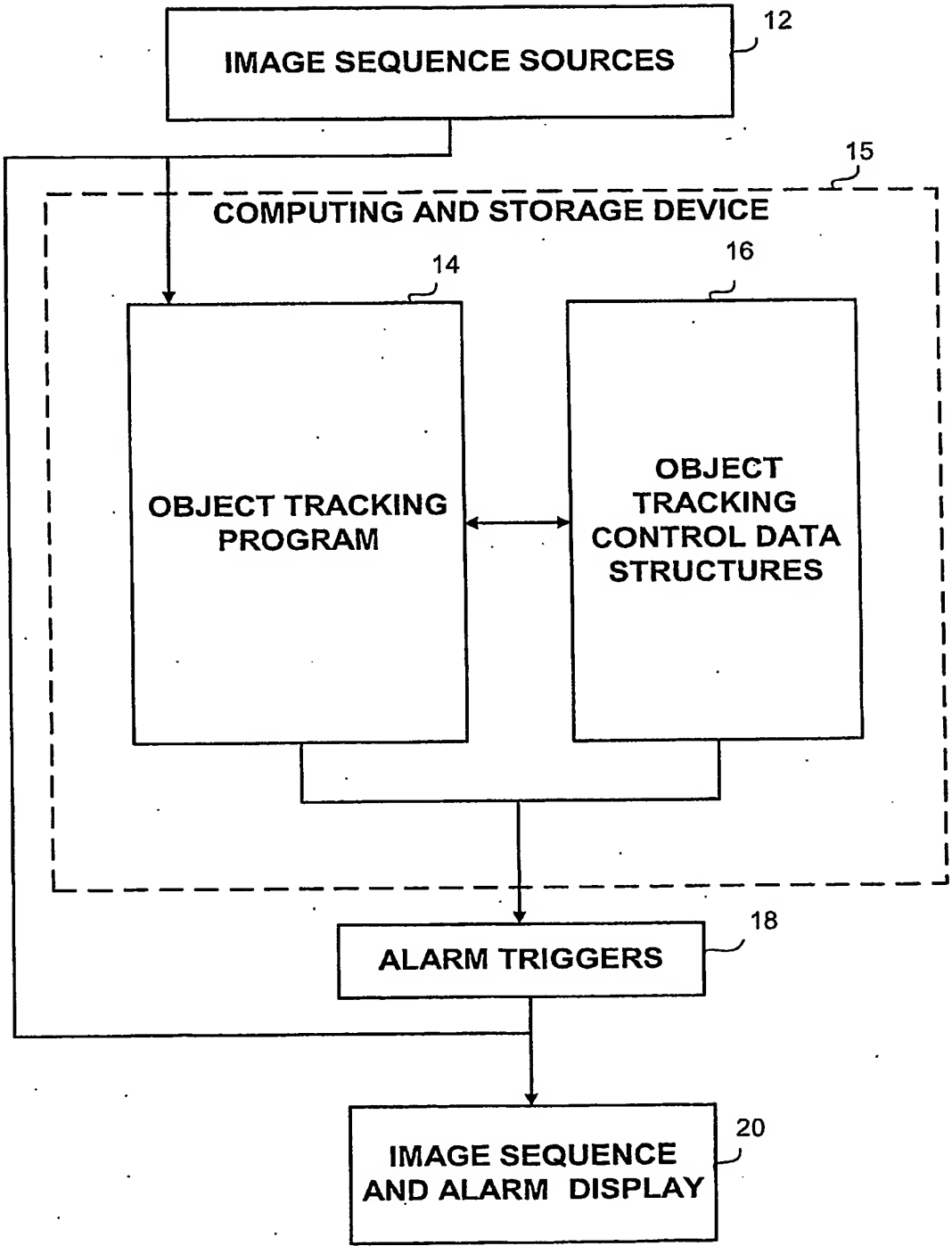


IMAGE SEQUENCE SOURCES
12
15
COMPUTING AND STORAGE DEVICE
14
16
OBJECT TRACKING PROGRAM
OBJECT TRACKING CONTROL DATA STRUCTURES
18
ALARM TRIGGERS
20
IMAGE SEQUENCE AND ALARM DISPLAY

FIG. 1

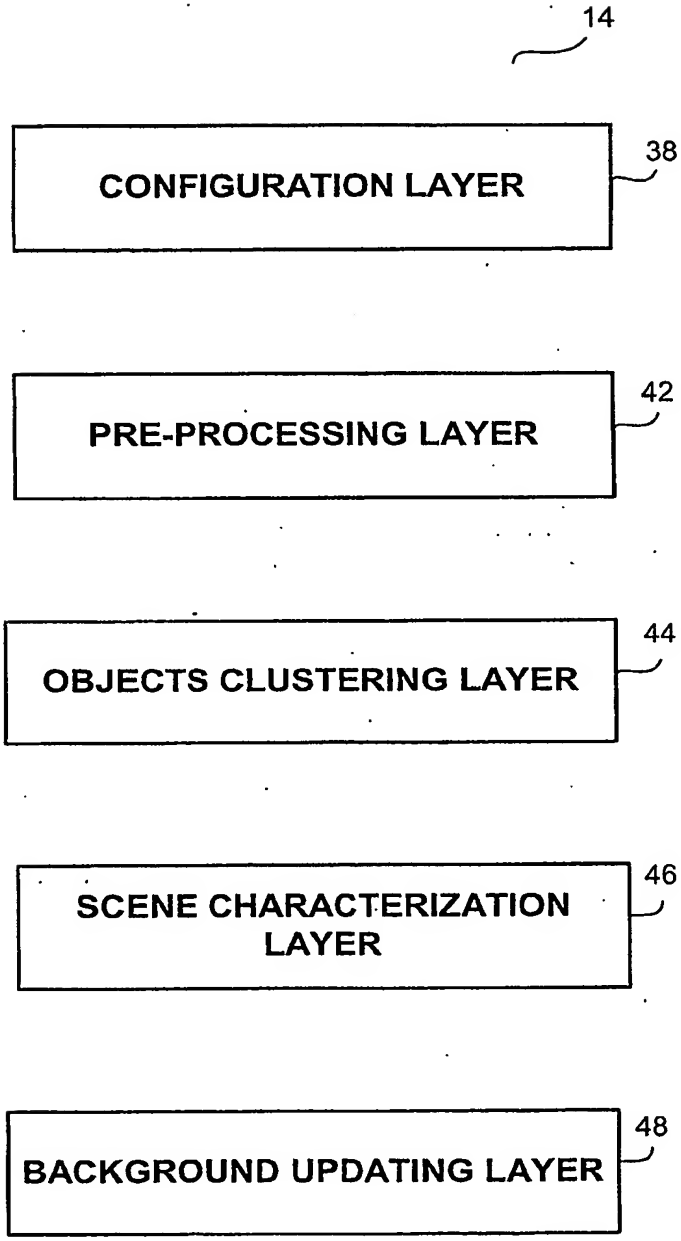

14
CONFIGURATION LAYER
38
PRE-PROCESSING LAYER
42
OBJECTS CLUSTERING LAYER
44
SCENE CHARACTERIZATION LAYER
46
BACKGROUND UPDATING LAYER
48

FIG. 2

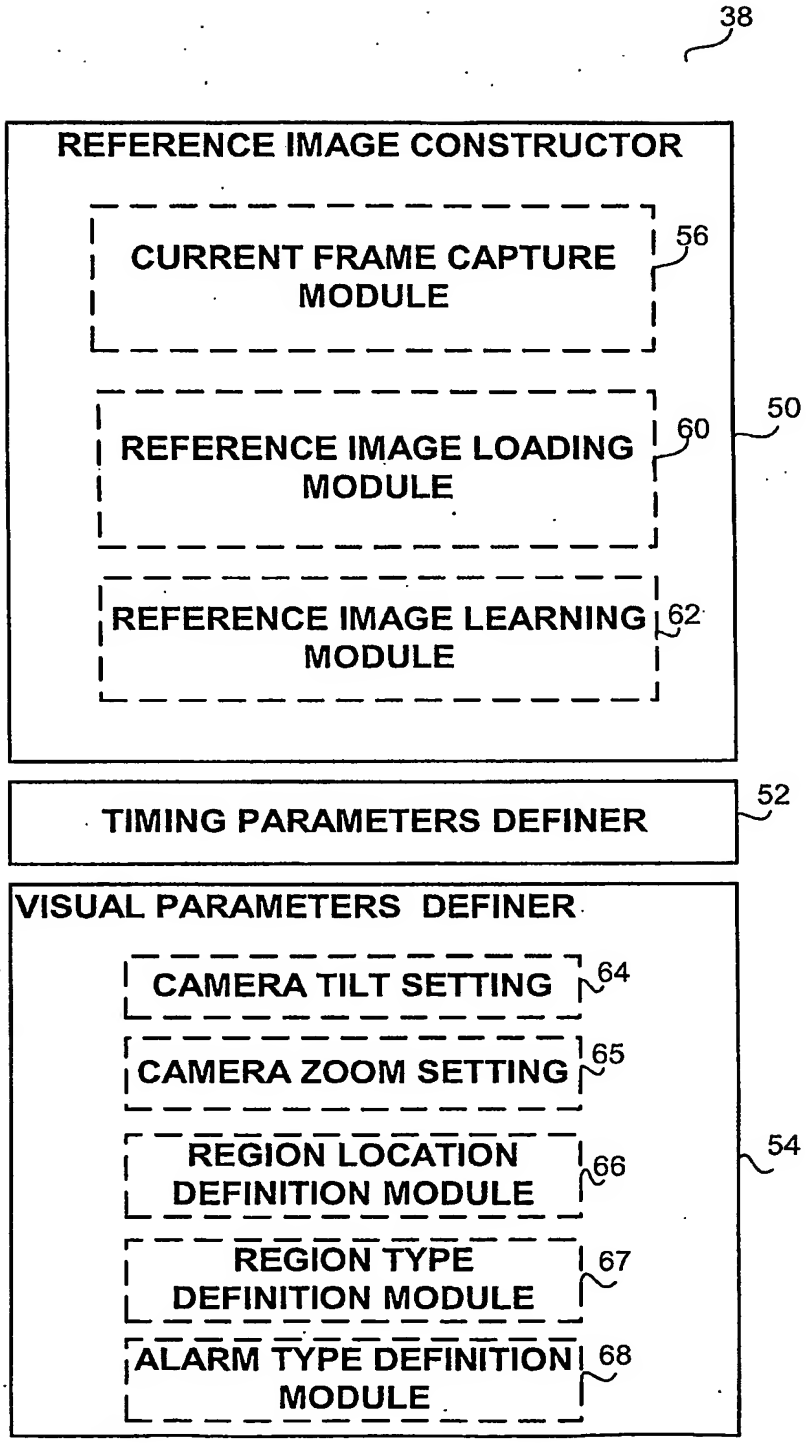

38
REFERENCE IMAGE CONSTRUCTOR
CURRENT FRAME CAPTURE MODULE
56
REFERENCE IMAGE LOADING MODULE
60
50
REFERENCE IMAGE LEARNING MODULE
62
TIMING PARAMETERS DEFINER
52
VISUAL PARAMETERS DEFINER
CAMERA TILT SETTING
64
CAMERA ZOOM SETTING
65
REGION LOCATION DEFINITION MODULE
66
54
REGION TYPE DEFINITION MODULE
67
ALARM TYPE DEFINITION MODULE
68

FIG. 3

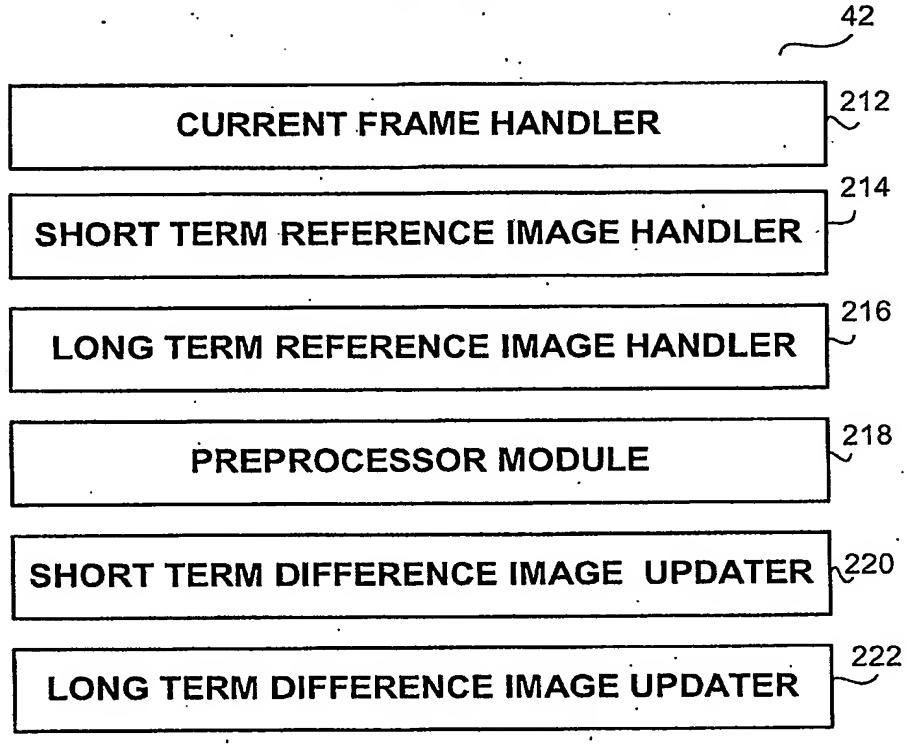

42
CURRENT FRAME HANDLER
212
SHORT TERM REFERENCE IMAGE HANDLER
214
LONG TERM REFERENCE IMAGE HANDLER
216
PREPROCESSOR MODULE
218
SHORT TERM DIFFERENCE IMAGE UPDATER
220
LONG TERM DIFFERENCE IMAGE UPDATER
222

FIG. 4A

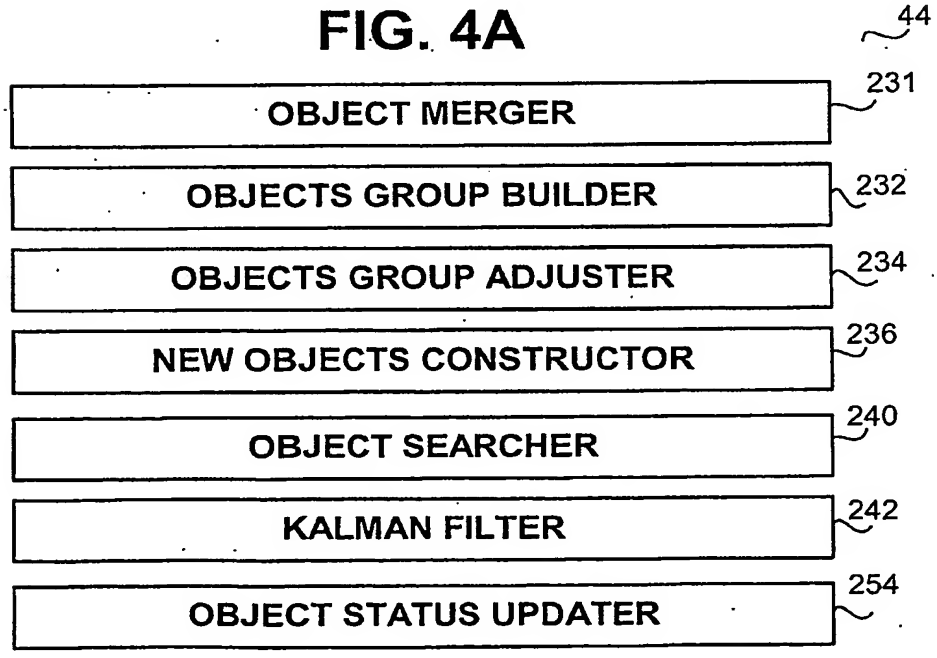

44
OBJECT MERGER
231
OBJECTS GROUP BUILDER
232
OBJECTS GROUP ADJUSTER
234
NEW OBJECTS CONSTRUCTOR
236
OBJECT SEARCHER
240
KALMAN FILTER
242
OBJECT STATUS UPDATER
254

FIG. 4B

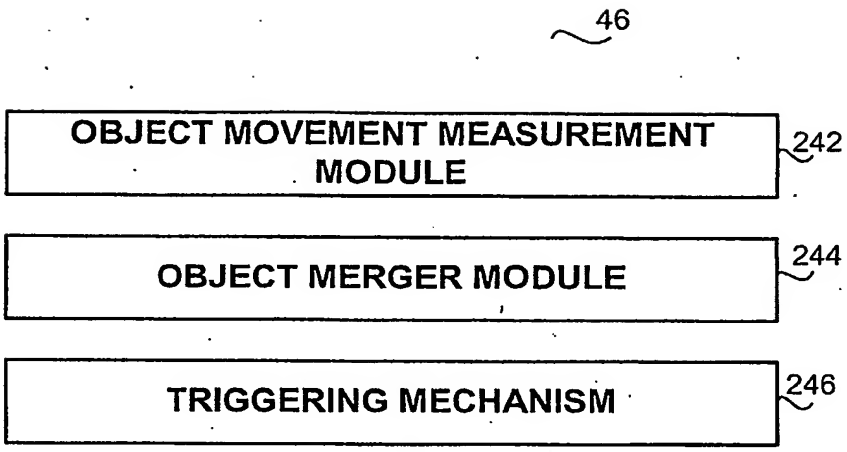

46
OBJECT MOVEMENT MEASUREMENT MODULE
242
OBJECT MERGER MODULE
244
TRIGGERING MECHANISM
246

FIG. 5A

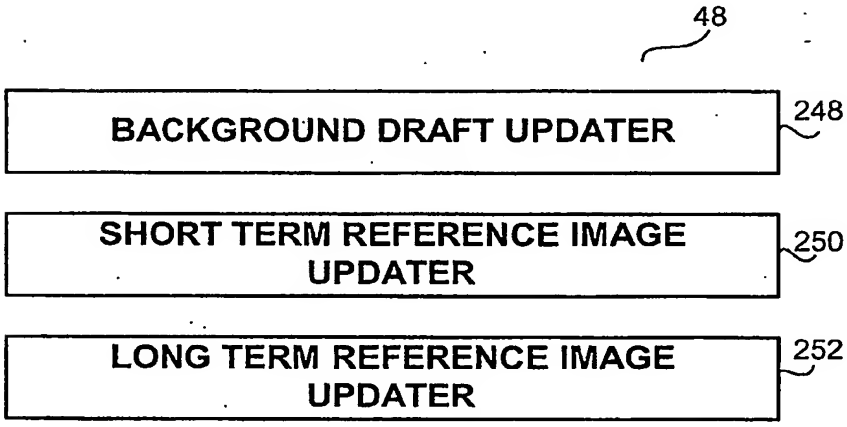

48
BACKGROUND DRAFT UPDATER
248
SHORT TERM REFERENCE IMAGE UPDATER
250
LONG TERM REFERENCE IMAGE UPDATER
252

FIG. 5B

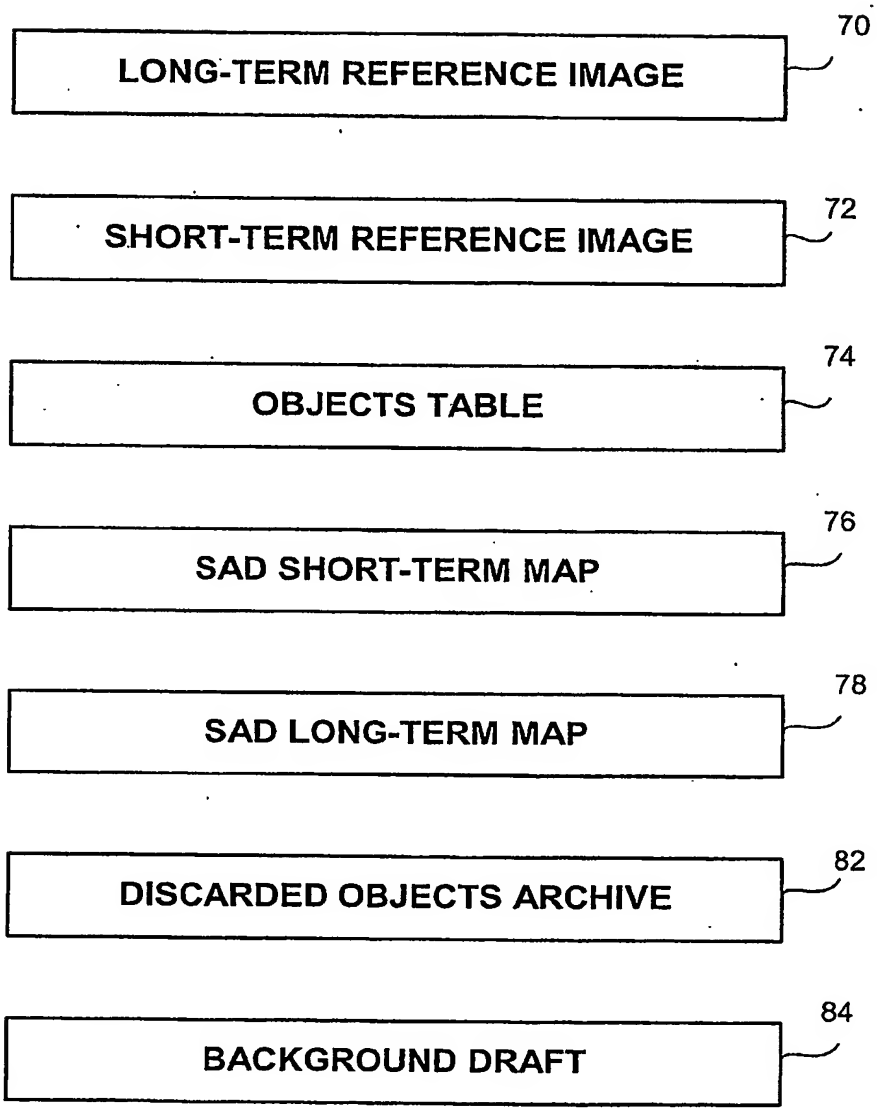

LONG-TERM REFERENCE IMAGE
70
SHORT-TERM REFERENCE IMAGE
72
OBJECTS TABLE
74
SAD SHORT-TERM MAP
76
SAD LONG-TERM MAP
78
DISCARDED OBJECTS ARCHIVE
82
BACKGROUND DRAFT
84

FIG. 6

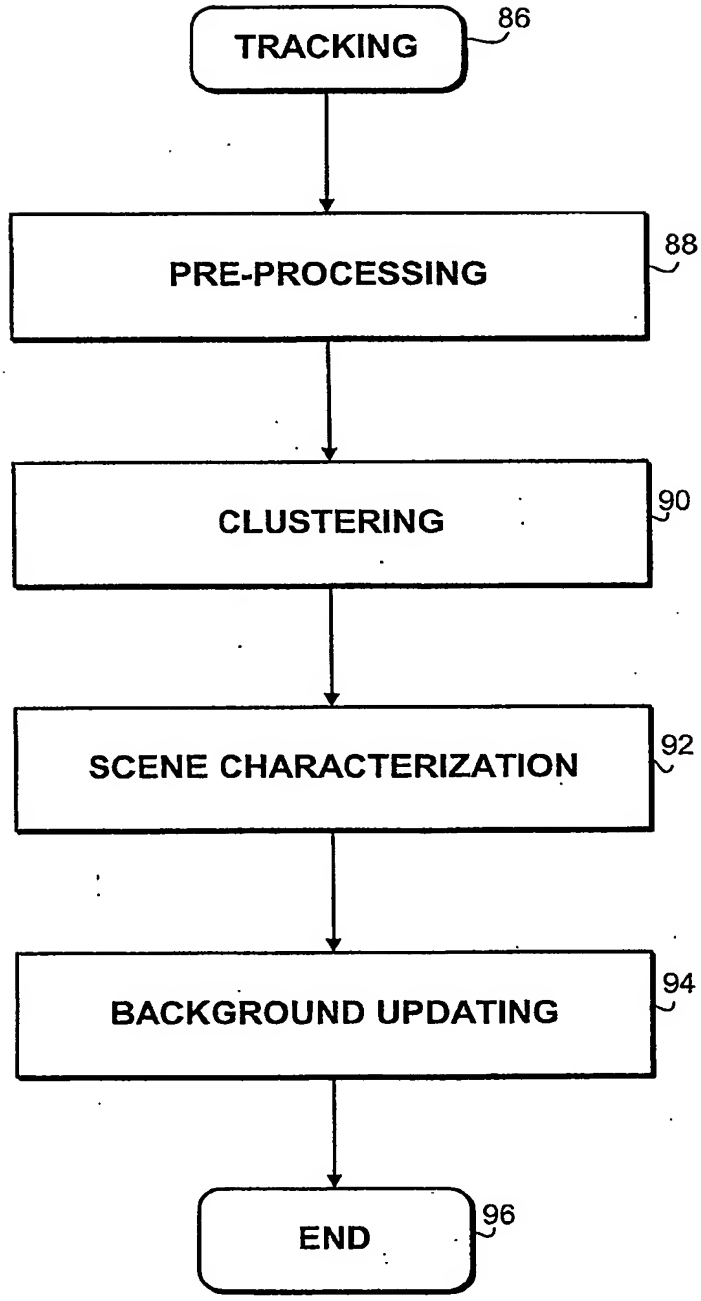

TRACKING
86
PRE-PROCESSING
88
CLUSTERING
90
SCENE CHARACTERIZATION
92
BACKGROUND UPDATING
94
END
96

FIG. 7

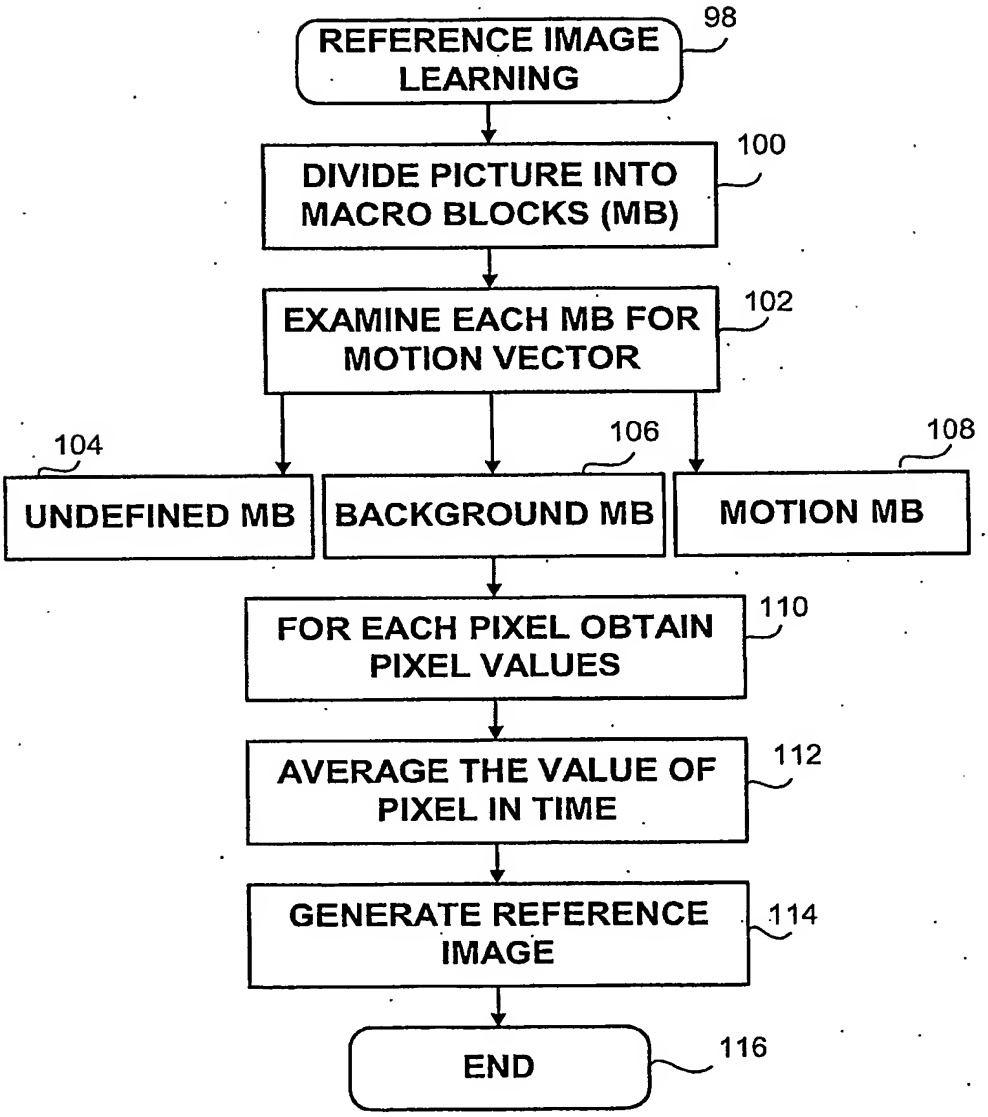

REFERENCE IMAGE LEARNING
98
DIVIDE PICTURE INTO MACRO BLOCKS (MB)
100
EXAMINE EACH MB FOR MOTION VECTOR
102
104
106
108
UNDEFINED MB
BACKGROUND MB
MOTION MB
FOR EACH PIXEL OBTAIN PIXEL VALUES
110
AVERAGE THE VALUE OF PIXEL IN TIME
112
GENERATE REFERENCE IMAGE
114
END
116

FIG. 8

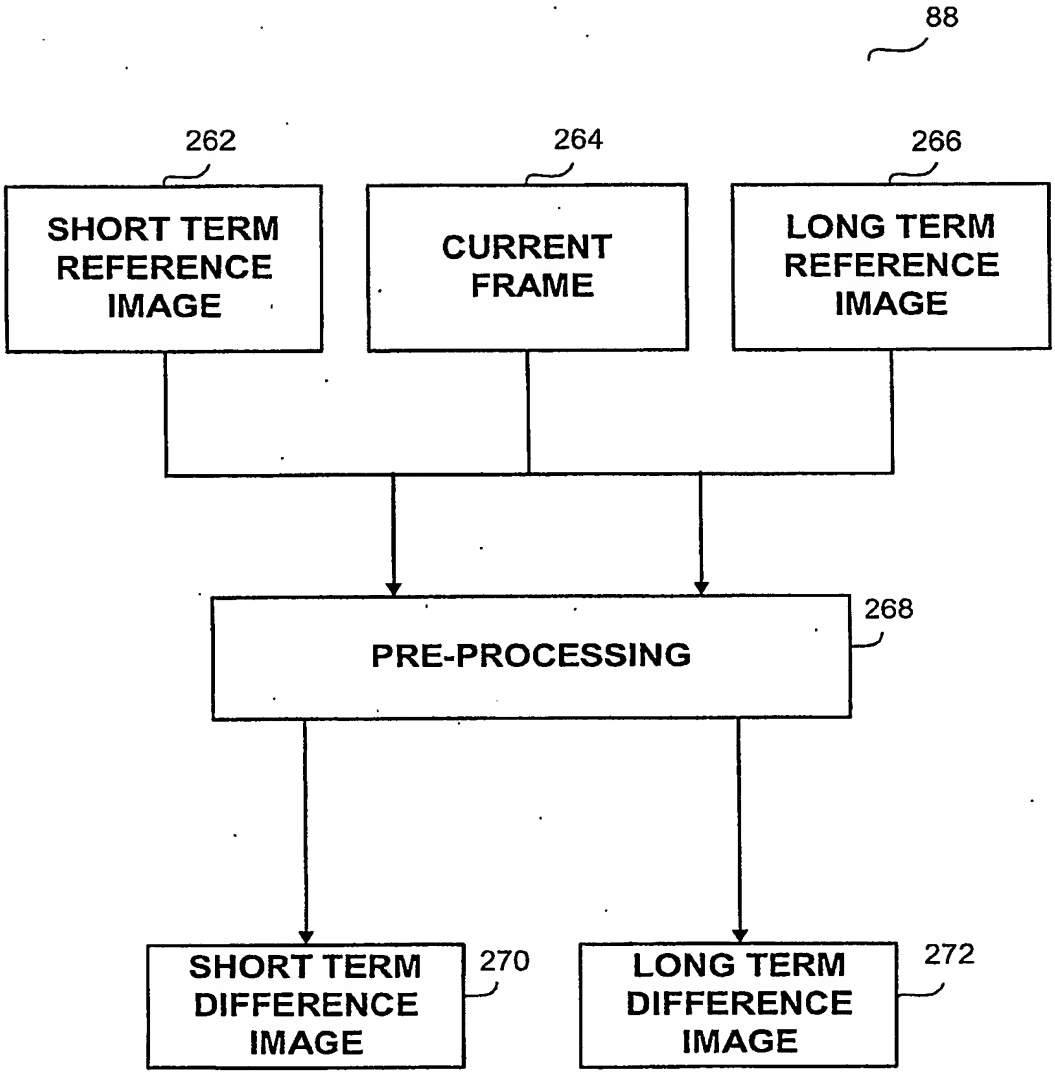

88
262
264
266
SHORT TERM REFERENCE IMAGE
CURRENT FRAME
LONG TERM REFERENCE IMAGE
PRE-PROCESSING
268
SHORT TERM DIFFERENCE IMAGE
270
LONG TERM DIFFERENCE IMAGE
272

FIG. 9

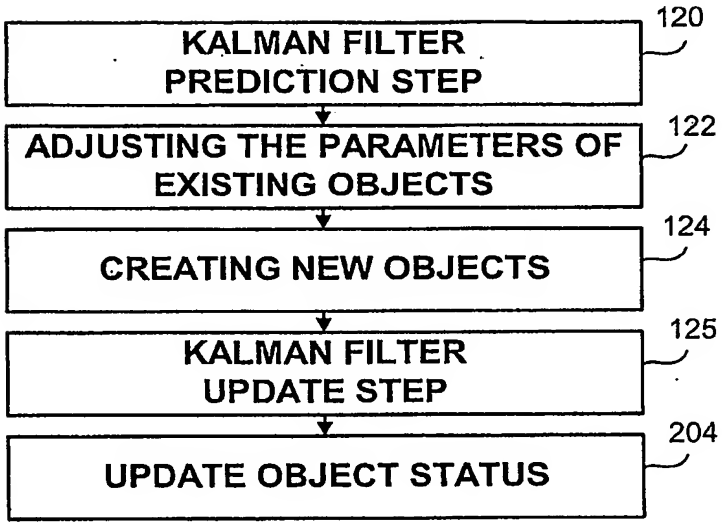


FIG. 10A

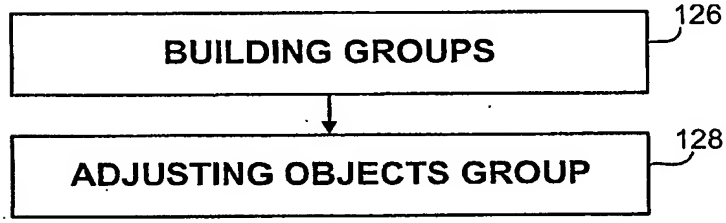


FIG. 10B

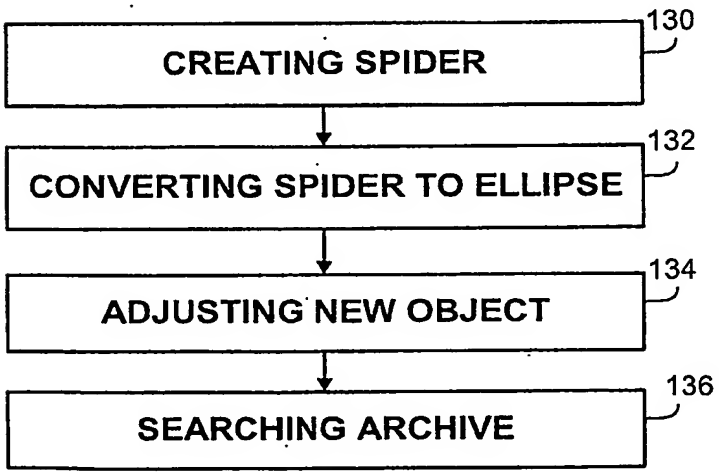


FIG. 10C

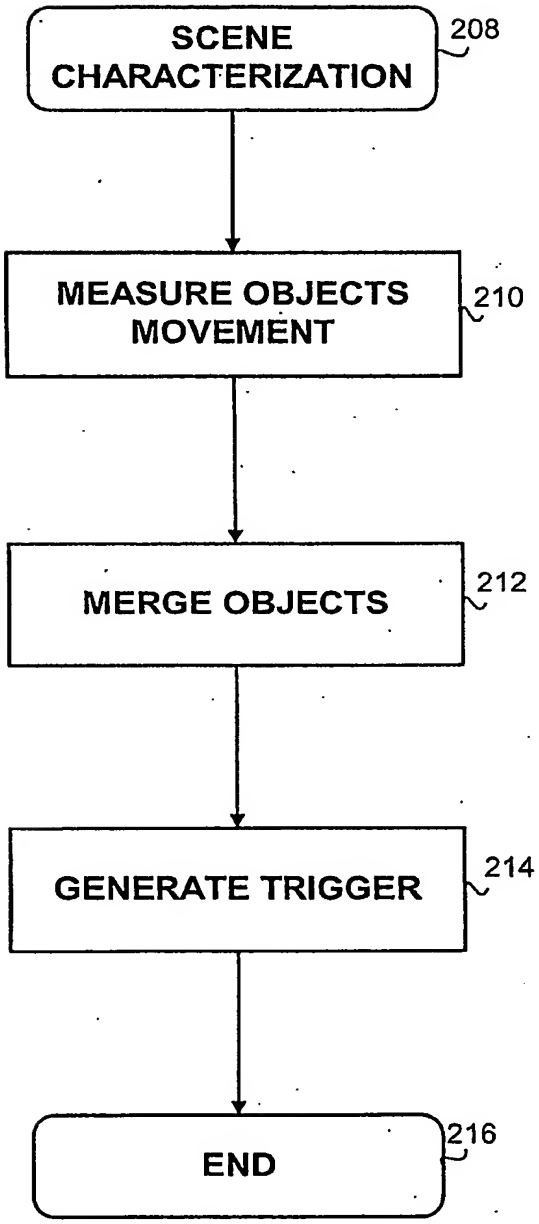

SCENE CHARACTERIZATION
208
MEASURE OBJECTS MOVEMENT
210
MERGE OBJECTS
212
GENERATE TRIGGER
214
END
216

FIG. 11

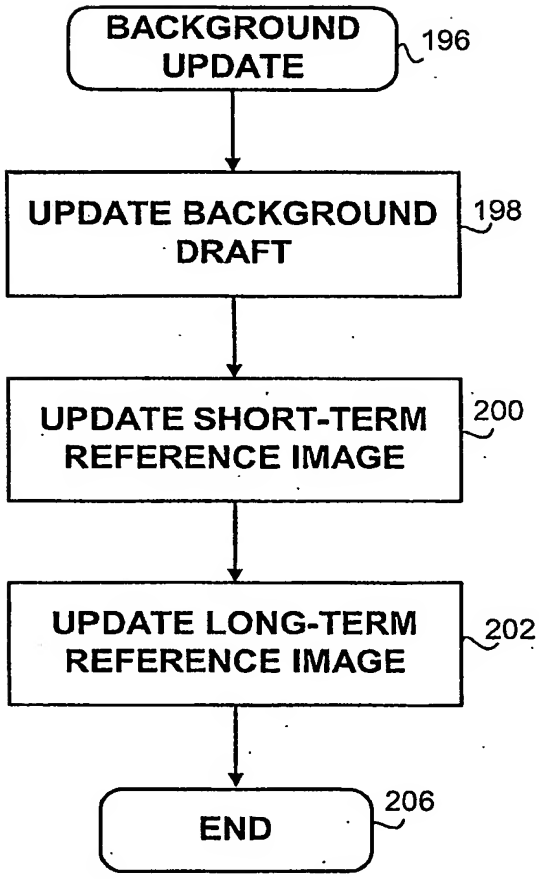

BACKGROUND UPDATE
196
UPDATE BACKGROUND DRAFT
198
UPDATE SHORT-TERM REFERENCE IMAGE
200
UPDATE LONG-TERM REFERENCE IMAGE
202
END
206

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL03/00097

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : H04N 7/12, 5/225, 5/228
US CL : 375/240.08; 348/169, 208.14, 208.16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 375/240.08; 348/169, 208.14, 208.16

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,091,780 A (POMERLEAU) 25 February 1992, figure 2, column 3, line 57 - column 6, line 21.	1-47
Y	US 5,307,170 A (ITSUMI et al) 26 April 1994, column 9, lines 25-40.	1-47
Y	US 5,734,441 A (KONDO et al) 31 March 1998 , figure 6, column8, lines 20-54.	1

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
19 May 2003 (19.05.2003)

Date of mailing of the international search report
05 JUN 2003

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703)305-3230

Authorized officer
Nhon T Diep
Telephone No. 703 305-2600

Form PCT/ISA/210 (second sheet) (July 1998)